PB90-115965

Superfund Record of Decision (EPA Region 5): Midco I, IN (First Remedial Action), June 1989

(U.S.) Environmental Protection Agency, Washington, DC

30 Jun 89

U.S. Department of Commerce
National Technical Information Service
NTIS

PB90-115965

United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R05-89/092
June 1989

EPA

Superfund Record of Decision:

MIDCO I, IN

REPRODUCED BY
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MIDCO I, IN
First Remedial Action - Final

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06/30/89

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401 M Street, S.W.
Washington, D.C. 20460

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800/000

14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

The MIDCO I site is a four-acre, abandoned industrial waste recycling, storage, and disposal facility in Gary, Indiana. The surrounding area is partially rural, including wetlands. Residential neighborhoods lie to the west, south, and east, with some residents living as close as 900 feet from the site. Twelve drinking water wells have been identified within approximately one mile of the site. The Calumet Aquifer, one of the two major aquifers underlying the site and providing water to these wells, is highly susceptible to contamination from surface sources. Recycling, storing, and disposing of industrial wastes began at the site sometime before June 1973. Within a three-year period, the site owners accepted and stockpiled approximately 6,000-7,000 55-gallon drums containing bulk liquid waste, and 4 bulk tanks, each 4,000-10,000 gallons. The facility closed in December 1976 after a fire burned approximately 14,000 drums of chemical waste. Operations resumed in October 1977 under new ownership. By February 1979 the new owners abandoned the facility, leaving thousands of drums and waste chemicals unattended. By January 1980 an estimated 14,000 drums were still stockpiled onsite. In June 1981 severe flooding caused water in the area to drain west into a neighboring city; contact with the flood water reportedly resulted in skin burns. In 1982 EPA initiated a surface removal action which included removing extensive surface
(See Attached Sheet)

17. Document Analysis a. Descriptors
Record of Decision - MIDCO I, IN
First Remedial Action - Final
Contaminated Media: soil, sediment, gw
Key Contaminants:VOCs (benzene, toluene, TCE), other organics (PCBs, PAHs, phenols), metals (chromium, lead)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 184
	20. Security Class (This Page) None	22. Price

(See ANSI-Z39.18) *See Instructions on Reverse* OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

EPA/ROD/R05-89/092
MIDCO I, IN
First Remedial Action - Final

16. Abstract (continued)

wastes, an underground tank, and the top one foot of contaminated soil. Because these activities did not address the contaminated subsurface soil, sediment, and ground water, EPA has initiated this first remedial action to address the above-referenced contaminated media. The primary contaminants of concern affecting the soil, sediment, and ground water are VOCs including benzene, toluene, and TCE; other organics including PCBs, phenols, and PAHs; and metals including chromium and lead.

The selected remedial action for this site includes excavation and treatment of 12,400 yd^3 of contaminated soil and subsurface materials using a combination of vapor extraction and solidification/stabilization, followed by onsite disposal; excavation and onsite solidification/stabilization of approximately 1,200 yd^3 of contaminated sediment in surrounding wetlands; covering the site in accordance with RCRA landfill closure requirements; ground water pumping and deep well injection in a Class I well if EPA grants a petition to allow land disposal of waste prohibited under RCRA; if a petition is not approved, ground water will be treated using air stripping and a liquid-phase granular activated carbon polish system to meet EPA requirements (LDR treatment standards), followed by deep well injection or reinjection into the aquifer; ground water monitoring; and implementation of deed and access restrictions. The estimated present worth cost for this remedial action is $13,989,000, which includes annual O&M costs of $525,000, if ground water is treated; or $10,728,000, which includes annual O&M costs of $188,000, if ground water is not treated.

ATTENTION

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DOCUMENT COMPLETE AS PAGINATED PER SOURCE.

DIRECT QUESTIONS RESULTING FROM ILLEGIBILITY TO:

U.S. EPA
OSWER - HSCD

- Installation and operation of a deep, class I, underground injection well for disposal of the contaminated ground water; or if a no-migration petition is disapproved by U.S. EPA, installation and operation of a treatment system for the contaminated ground water to remove hazardous substances followed by deep well injection of the salt-contaminated water; or installation and operation of a treatment system for the contaminated ground water to remove hazardous substances followed by reinjection of the salt-contaminated ground water into the Calumet aquifer in a manner that will prevent spreading of the salt plume;
- Installation of a final site cover satisfying RCRA closure requirements, if applicable or if considered relevant and appropriate (the quality of cap required will also depend on the results of tests on the solidified material);
- Restriction of site access and imposition of deed restrictions as appropriate;
- Related testing and long term monitoring.

The groundwater treatment and underground injection portions of the remedial action may be combined with the remedial action for Midco II. In this case, the combined treatment constitutes an on-site action, for purposes of the Off-site Policy.

DECLARATION

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate to this remedial action and is cost-effective. This remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility or volume as a principal element and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

Because this remedy will result in hazardous substances remaining onsite above health-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Valdas V. Adamkus

Signature of Regional Administrator

Date June 30th, 1989.

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Midco I
Gary, Indiana

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Midco I site in Gary, Indiana, developed in accordance with CERCLA, as amended by SARA, and, to the extent practicable, the National Contingency Plan. This decision is based on the administrative record for this site. The attached index identifies the items which comprise the administrative record upon which the selection of the remedial removal action is based.

The State of Indiana is expected to concur with the selected remedy.

DESCRIPTION OF THE SELECTED REMEDY

This is the final remedial action for the Midco I. A surface removal action including removal and off-site disposal of wastes in drums and sub-surface tanks and the top one foot of contaminated soil was completed in 1982. The final remedial action will treat the highly contaminated subsurface soils and materials that remain at the site and that are contributing to ground water and surface water contamination near the site, and will treat the highly contaminated ground water near the site. These actions will address the principal threats posed by the site which include public health risks due to future development of the site, public health risks due to off-site migration of ground water and, public risks due to air emissions, and environmental impacts on surrounding wetlands.

The major components of the selected remedial actions include:

- On-site treatment of an estimated 12,400 cubic yards of contaminated soil and waste material by a combination of vapor extraction and solidification/stabilization followed by on-site deposition of the solidified material. The soil vapor extraction system will be considered successful when volatile organic compounds are reduced to levels that will pose no health threat and allow solidification/stabilization to proceed successfully. The solidification/stabilization operation will be considered successful when it reduces the mobility of contaminants so that leachate from the solid mass will not cause exceedance of health based levels in the ground water.

- Excavation and on-site solidification/stabilization of approximately 1200 cubic yards of contaminated sediments in surrounding wetlands;

- Installation and operation of a ground water pumping system to intercept contaminated ground water from the site;

RECORD OF DECISION SUMMARY

MIDCO I, GARY, INDIANA

I. SITE NAME, LOCATION AND DESCRIPTION

The Midco I site occupies approximately four acres and is located at 7400 W. 15th Avenue, Gary, Indiana (Figure 1). This is in the southwest quarter of the northwest quarter of Section II, Township 36 North, Range 9 west. This is in a light industrial area. The site is within one fourth mile of a residential neighborhood in Hammond, Indiana, and within 3000 feet of a residential neighborhood in Gary, Indiana. There is also a resident living about 900 feet south of the site. It is bordered by an Indiana Department of Highways maintenance facility on the west, sand ridges and wetlands to the north, cut and fill land on the east and a private building on the south. (Figure 2). The Ninth Avenue Dump, an NPL site, is located approximately 1/4 mile north of Midco I.

The site is located approximately 3.8 miles south of Lake Michigan and lies midway between the Grand Calumet River and the Little Calumet River, both of which flow into Lake Michigan. It lies in the Calumet Lacustrine Plain.

Topography:

The original relief of this site, as well as the surrounding area, included alternating east-west trending ridges and swales. Originally, two swales crossed what is now the Midco I site. However, the topography of the site as well as of the surrounding area has been modified by man to a great extent and is only locally preserved. The site itself is now level and is underlain by sandy soil. A surface removal action was completed in 1982 to remove all wastes in drums, tanks and the top one foot of contaminated soil. The remaining contamination of concern is in subsurface soils and materials, and the ground water.

Ecology:

There is evidence of the original ridge and swale topography just north of the site. Despite the industrial and commercial use of the land, much of the area around the site contains wooded and ponded areas that provide habitat for fish and wildlife. A relatively undisturbed wetland area approximately 1000 feet north of the site and surrounding the Ninth Avenue Dump Superfund site has been designated by the U.S. EPA and the U.S. Army Corps of Engineers as unsuitable for filling because of natural resources values. However, the more disturbed wetlands closer to Midco I have not been so designated.

There are a number of relatively undisturbed, state-dedicated nature preserves within three miles of the site. These areas as well as other relatively undisturbed sites, provide habitat for a wide variety of migratory and resident wildlife. The southern end of Lake Michigan and

-1-a

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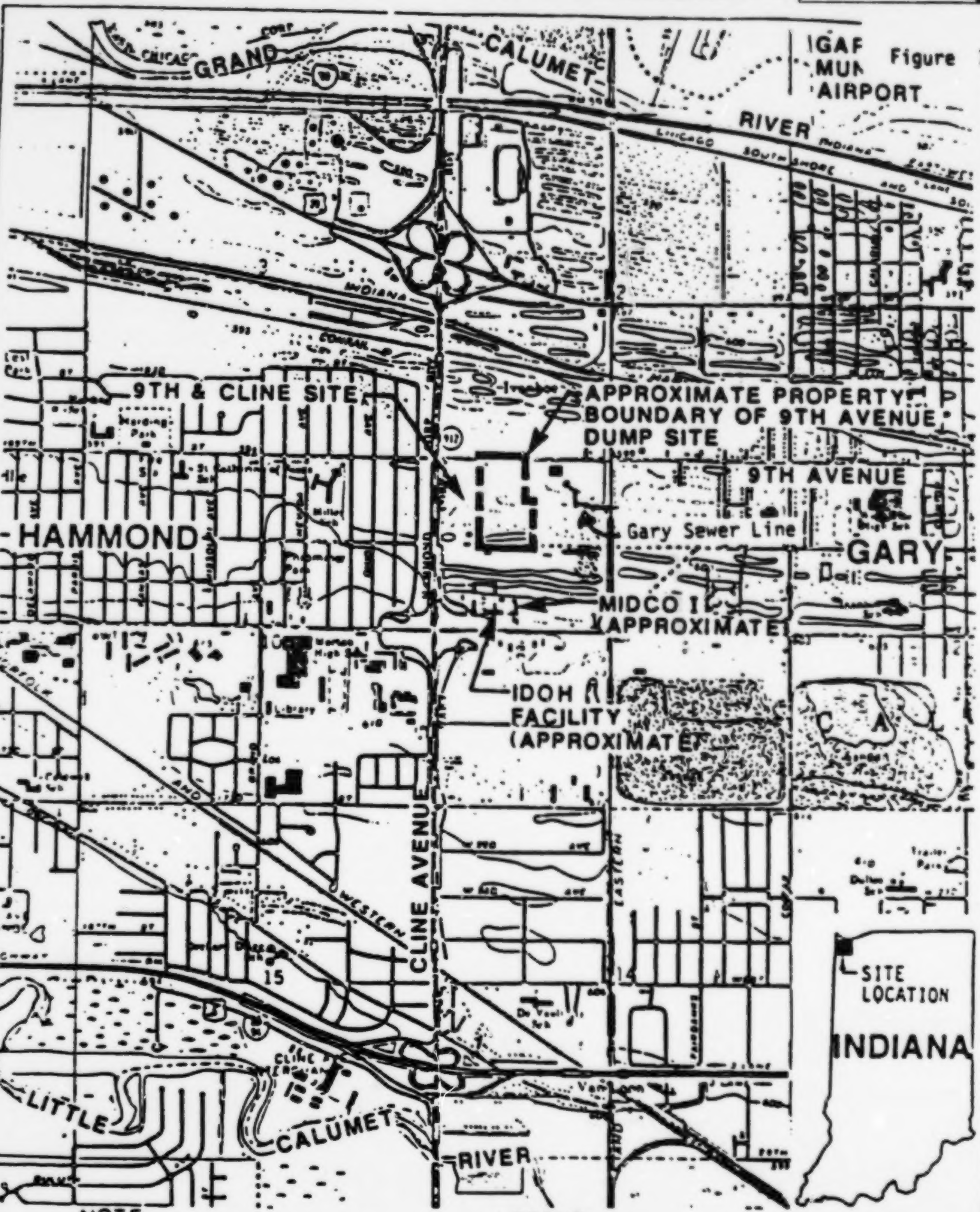


Figure 1
GRAND CALUMET RIVER
GAF MUN AIRPORT
9TH & CLINE SITE
APPROXIMATE PROPERTY BOUNDARY OF 9TH AVENUE DUMP SITE
9TH AVENUE
HAMMOND
Gary Sewer Line
GARY
MIDCO I (APPROXIMATE)
IDOH FACILITY (APPROXIMATE)
CLINE AVENUE
LITTLE CALUMET RIVER
SITE LOCATION
INDIANA

NOTE

SITE LOCATION MAP WAS REPRODUCED FROM THE U.S.G.S. 7.5 MINUTE QUAD. MAP, HIGHLAND, INDIANA, 1968, PHOTO REVISED 1980. REFER TO STANDARD U.S.G.S. TOPOGRAPHIC MAP SYMBOLS.

LEGEND

— — — APPROXIMATE PROPERTY BOUNDARY

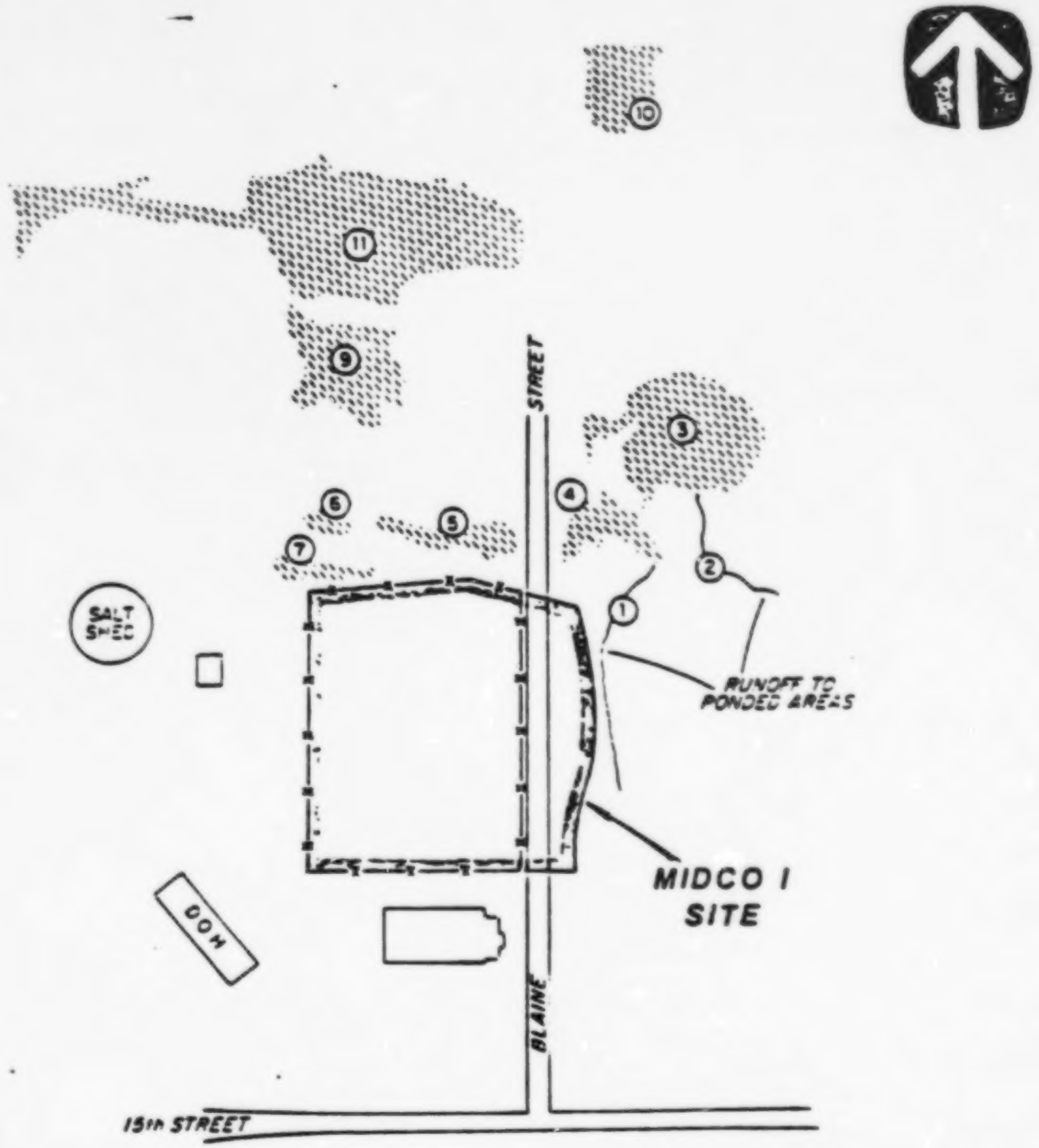
north

FIGURE 1-1

SCALE: 1" = 2000'

WARZYN	SITE LOCATION MAP FEASIBILITY STUDY

Figure 2


10
11
9
STREET
3
4
6
5
7
2
1
SALT SHED
RUNOFF TO PONDED AREAS
MIDCO I SITE
DOM
BLAINE
15th STREET

KEY:
SITE BOUNDARY
FENCE LOCATION AND PROPERTY BOUNDARY
AREA OF STANDING WATER
0
100
200
300
SCALE IN FEET

FIGURE 1-2
MIDCO I
SITE
BOUNDARIES

Dames & Moore

nearby habitats are a convergence area for migratory birds following the north-south boundaries of the Lake.

Habitats near Midco I support a variety of fish and wildlife populations. Nesting mallards were observed in wetland habitats between Midco I and Ninth Avenue Dump. The mallard has been designated as species of Special Emphasis by the U.S. Fish and Wildlife Service. Other birds seen in the area were spotted sandpipers, killdeer, goldfinches and red-winged blackbirds. Midco I is also within the range of the Federally-designed endangered Indiana bat.

In addition, the following State of Indiana-designated endangered species were observed near Midco I: the American bittern; broad winged hawk, mudpuppy and Franklin's ground squirrel. One dead grey birch was observed, which is on the Indiana Threatened Plant list. The ponded area 400 feet north of the site contained green sunfish, black crappy, mudminnow, carp, black bullhead, crayfish, and snapping turtle.

Ground Water:

The Midco I site is underlain by two distinct aquifer units. The sandy surface deposits, about 30 feet in thickness, comprise a surficial unconfined aquifer (Calumet Aquifer) with a saturated thickness of 20 to 25 feet. This aquifer has good yield potential and is very susceptible to contamination from surface sources because of the high water table and the very permeable sandy nature of the surface soils. A 110-foot thick sequence of silty clay and silt loam till separates this aquifer from a bedrock aquifer of the Silurian Age. Available specific capacity data suggest that the top few hundred feet of this aquifer has limited yield capacity.

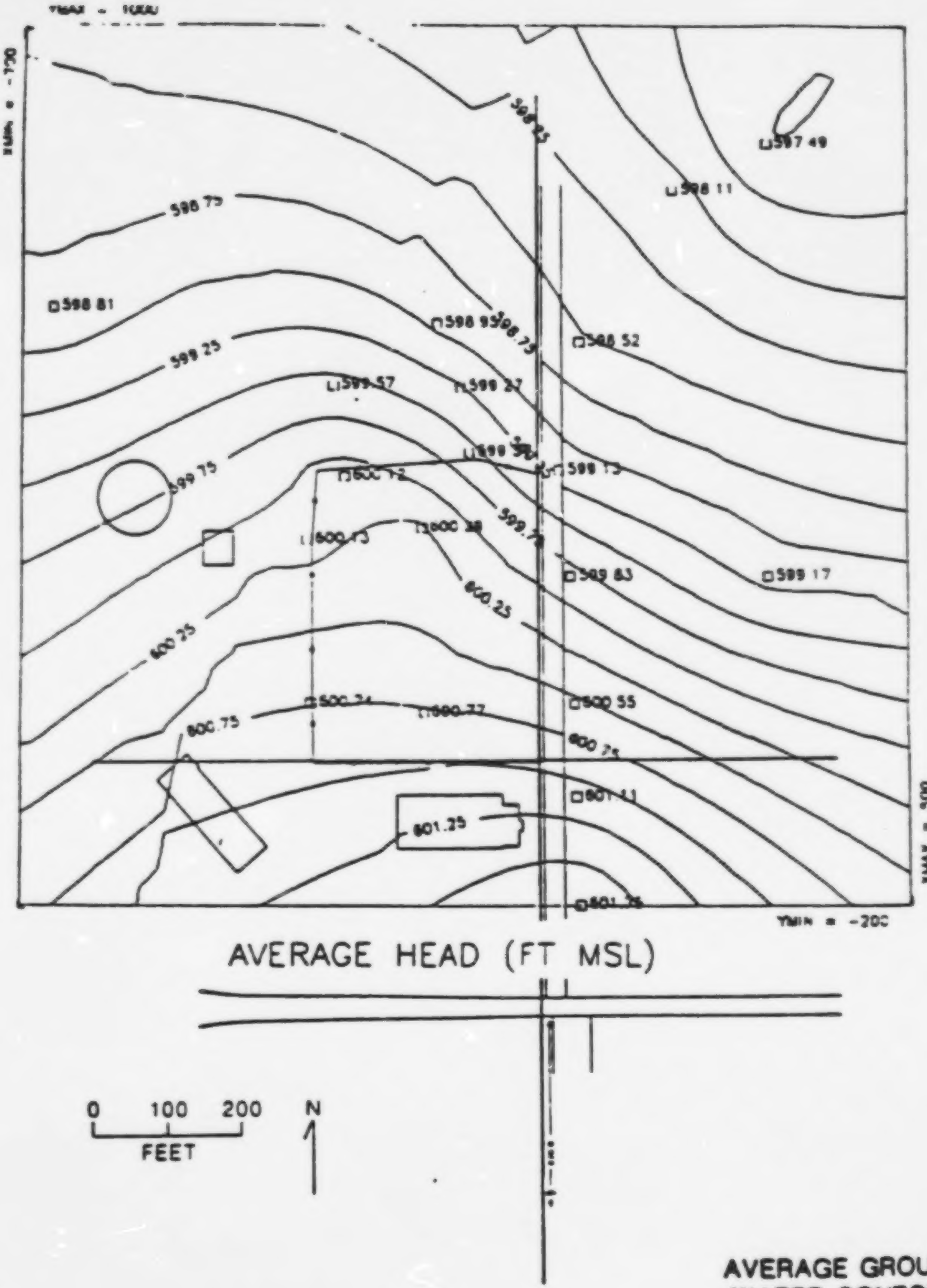
The direction of ground water flow in the Calumet aquifer is to the north and northeast from the site as indicated in Figure 3. The rate of ground water movement is only about 70 feet per year because of the very low hydraulic gradient. An estimate of the vertical flow rate through the clay confining layer is 2 feet per year.

According to an ongoing United States Geological Survey study, the ground water movement in the Calumet aquifer is locally affected by ditches and leaky sewers. The groundwater discharge to ditches and leaky sewers often causes a fully penetrating effect on the flow in the aquifer. A City of Gary sewer is located 2700 feet north-northeast of the site in the down gradient flow direction from the site (Figure 1). It is not known whether this sewer is leaking, but its manhole does drain the wetland east of Ninth Avenue Dump during high water conditions.

The predominant source of water for both potable and non-potable uses in the Midco I area is Lake Michigan. In spite of this, the well inventory conducted in the Remedial Investigation identified 68 private wells screened in the Calumet aquifer within approximately one-mile of Midco I. This includes 16 wells potentially in the downgradient ground water flow direction from the site; twelve of which are used for drinking.

-2-a

Figure 3


YMAX = 1000
XMIN = -750
598.25
597.49
598.11
598.75
598.81
598.95
598.75
598.52
599.25
599.57
599.27
599.39
599.13
599.75
600.12
600.13
600.39
599.75
599.83
599.17
600.25
600.25
600.24
600.77
600.55
600.75
600.75
601.11
601.25
601.75
XMAX = 300
YMIN = -200
AVERAGE HEAD (FT MSL)
0 100 200
FEET
N

AVERAGE GROUND
WATER CONTOUR

FEBRUARY-MAY 1986

Surface Drainage:

Surface water levels are intimately related to ground water levels in the surficial aquifer. Surface water drains into the wetlands north and east of the site. It was also observed that contaminated ground water from the site seeps into the adjacent wetlands east of the site. Most of the time, there is no discharge from these wetlands. However, during the spring melt and periods of heavy precipitation, surface water migrates slowly northward through wetlands into the wetlands surrounding 9th Avenue Dump. During periods of high water levels, the wetlands surrounding 9th Avenue Dump drain into the sewer shown in Figure 1. This sewer leads to the Gary Wastewater Treatment Plant.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

Midwest Solvent Recovery (Midco I) began industrial waste recycling, storage, and disposal at the site sometime prior to June 1973. The Midco I site was used for disposal of a variety of industrial wastes including unknown quantities of bulk liquid industrial wastes. Waste handling methods included open storage and stockpiling of 55 gallon drums.

In November 1973, an Indiana State Board of Health (ISBH) inspector estimated that 6000 to 7000 drums were stockpiled on the site. Later, inspections by ISBH noted even more drums on the site and drums in a state of disrepair.

Four bulk tanks ranging from 4,000 to 10,000 gallons each were on site in mid-1976. The leakage of drums and bulk tanks on site has been documented. A large pit on site was used for disposal of industrial sludges and residues.

On December 21, 1976, a fire broke out at Midco I. An estimated 14,000 drums of chemical waste burned in the fire, causing emission of toxic fumes. Shortly after the fire, Midco operations were relocated to 5900 Industrial Highway, Gary, Indiana, operating under the name Midwest Industrial Waste Disposal Company, Inc. (Midco II). Active operation was renewed at the Midco I site in October 1977 when it was taken over by Industrial Tectonics, Inc. (Intec).

On February 24, 1978, the Lake County Circuit Court ordered the operator of Midwest Solvent Disposal Company to remove and properly dispose of the fire-damaged drums of cyanide and other industrial wastes from Midco I and Midco II within 90 days. This order was never obeyed.

In approximately February 1979, Intec discontinued operations leaving thousands of drums of waste chemicals unattended on the site. One property owner bulldozed drums of waste off his property causing rupturing of some drums.

During 1979, the ISBH, U.S. EPA and the Gary Fire Department conducted investigation at the site. Based on the results of these efforts, the

United States filed a complaint in the Federal District Court in Hammond, Indiana under Section 7003 of the Resource Conservation and Recovery Act (RCRA) (Civil Action No. H-79-556). A Preliminary Injunction and Temporary Restraining Order were granted on January 31, 1980, that directed Intec to remove certain surface wastes from Midco I. By further order of the Court on December 4, 1980, Intec was required to remove certain surface wastes from Midco I.

On December 4, 1980, the operators of Midwest Solvent Disposal Company were ordered to submit to U.S. EPA a plan for removal of all wastes stored on the site not attributable to Intec, and to design a plan to determine the nature and extent of the soil and ground water contamination. However, these court actions were ineffective, and in late January 1980, an estimated 14,000 drums were stockpiled up to four drums high, and thousands of fire-damaged drums still remained on the ground. In June 1981, the EPA enclosed the site with a fence. In June 1981, severe flooding caused water in the area to drain west into Hammond. Contact with this flood water reportedly caused skin burns, which many believe were due to drainage from Midco I and the Ninth Avenue Dump, located north of Midco I.

The U.S. EPA funded a hydrogeologic study performed from June 1981 to September 1982 to provide a preliminary indication of contaminants present in the soil and ground water, to determine ground water flow, and to define the extent of contamination related to the site.

The U.S. EPA announced on January 27, 1982, the allocation of funds and a contract award for the removal of hazardous waste from the Midco I site. This action was conducted from February 26 to July 7, 1982. It included removal and off-site disposal of approximately 7,000 cubic yards of crushed drums, 84,000 gallons of solvents, 5,600 gallons of acids, 13,500 gallons of bases, 56,500 gallons of inert compounds, 940 drums of flammable solids, 170 labpacks, and 7,200 cubic yards of contaminated soil (the top 1 foot).

It also included placing a 6-12 inch clay soil cover over most of the site. In addition, 840 drums of wastes were removed from the site by a responsible party, and one surface tanker was removed by Intec. This concluded the surface removal action but the contaminated soil and ground water had not been addressed.

Midco I was placed on the National Priorities List (NPL) in December 1982. The NPL is a list of abandoned or uncontrolled hazardous waste sites that are eligible for investigation and remediation under CERCLA.

On January 19, 1984, the United States filed its First Amended Complaint for Civil Action No. H-79-556 adding claims for injunctive relief under Section 106 of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), and recovery of response costs incurred by the United States under Section 107 of CERCLA and adding generator defendants.

The U.S. EPA completed a Work Plan for a Remedial Investigation/ Feasibility Study (RI/FS) for this site, and initiated field work for the RI/FS in February 1985. The purpose of the RI was to collect data needed to determine the full extent of hazards remaining at the site and to evaluate alternatives for remedial actions. The RI included geophysical, soil gas, soil, hydrogeological, surface water, surface sediment and ground water investigations. However, the U.S. EPA agreed to discontinue its work on the RI/FS in April 1985, when a group of defendants agreed to conduct the RI/FS in accordance with the U.S. EPA-approved Work Plan.

An agreement was formalized on June 19, 1985 by a Partial Consent Decree in United States of America v. Midwest Solvent Recovery, Inc. et. al. lodged with the United States District Court for the Northern District of Indiana. This Partial Consent Decree required reimbursement of past costs and specified that an RI/FS be completed in accordance with the U.S. EPA's Work Plan for the Midco I site by the Defendants. Litigation was stayed until completion of the RI/FS.

The contractor for the defendants started work in May 1985. After review of the first draft Remedial Investigation (RI) report, U.S. EPA required additional sampling in February 1987. This sampling was completed and a final RI report was approved by U.S. EPA in December 1987. The contractor submitted a final FS report in February 1989.

III. COMMUNITY RELATIONS

A public meeting was held on February 21, 1985, to explain the proposed Remedial Investigation/Feasibility Study. U.S. EPA updated the community on the status of the RI/FS using fact sheets in November 1987 and December 1988.

A Proposed Plan was prepared explaining alternatives evaluated and the basis for preference for one alternative. The Plan was mailed to over 100 persons in the community. Availability of the Plan was published in two local newspapers. A public comment period was held from April 20 to May 19, 1989. A public meeting was held on April 27, 1989 in a high school near the site.

Verbal public comments were received during the public meeting. Written comments were received from one resident of Gary, from the City of Hammond, from the Indiana Department of Environmental Management, and from members of the Midco Steering Committee, which represents potentially responsible parties at the site. A summary of their major comments as well as U.S. EPA's response to them is included in the Responsiveness Summary in the Appendix.

The U.S. EPA-selected remedial actions identified in the Record of Decision differ from the preferred alternative described in the Proposed Plan in the follow ways:

1. As an alternative to deep well injection, the option of reinjection of the ground water back into the Calumet aquifer

is allowed following treatment, with the condition that this operation not cause spreading of the salt plume.

2. A Treatability Variance is approved for the solidification/ stabilization (S/S) operation from the Land Disposal Restriction (LDR) Treatment standards. This is being approved because existing available data do not demonstrate that S/S can attain LDR treatment standards consistently for all soil and debris at this site. The Treatability Variance allows attainment of standards that have been demonstrated to be attainable for soil and debris.

IV. SCOPE AND ROLE OF THE RESPONSE ACTION

Removal of surface wastes, an underground tank and the top one-foot of contaminated soil was completed by U.S. EPA in 1982. This Record of Decision is for the final remedial action and will address the remaining contamination at the site including contaminated subsurface soil and fill materials, contaminated ground water and contaminated surface sediments.

V. SITE CHARACTERISTICS

The RI showed that on-site subsurface soils are highly contaminated by a large number of chemicals and contain some crushed drums and other debris. Ground water below the site is also highly contaminated, but the contaminated ground water does not extend very far from the site. Some surface sediments near the site have also been contaminated. The ground water was also highly saline, it appears largely due to run-off from the adjacent Indiana Department of Highways facility.

Source:

On-site subsurface soil and debris are a continuing source of contaminants to the ground water and surface water. Fourteen test trenches were excavated into the most contaminated portions of the site and nineteen samples were collected to characterize the extent and nature of this source. The east-central portion of the site has the highest contamination. The minimum, maximum and mean concentrations of chemicals detected in these samples are summarized in Table 1 in the Appendix. Elevated concentrations of the following chemicals were detected:

methylene chloride
acetone
2-butanone
4-methyl-2-pentanone
toluene
ethylbenzene
xylene
phenol
bis(2-ethylhexyl) phthalate
1,1,1-trichloromethane
trichloroethene
tetrachloroethane

barium
cadmium
chromium
copper
lead
nickel
zinc
cyanide

benzene
chlorobenzene
isophorone
butyl benzyl phthalate
di-n-butyl phthalate

A large number of polyaromatic hydrocarbons were detected at up to a few hundred mg/kg. PCBs were detected in one sample at 44 mg/kg. Pesticides were detected in two samples at below 10 mg/kg.

Total volatile organic compounds were as high as 1.1% by weight and consisted predominantly of methylene chloride, 2-butanone, toluene, ethylbenzene, xylene, trichloroethene, 4-methyl-2-pentanone and chlorobenzene.

Total semivolatile organic compounds were as high as 0.8% by weight and consisted predominantly of phenol, polyaromatic hydrocarbons, phthalate and alkanes. Cyanide was as high as 2,720 mg/kg; chromium as high as 10,200 mg/kg; and lead as high as 4,980 mg/kg.

The estimated volume of contaminated subsurface soil and debris above the water table is 12,400 cubic yards.

Surface Water:

Surface water samples were collected at eleven locations during two rounds of sampling. The maximum, minimum and average concentrations are summarized in Table 1. The sampling locations along with the results from total volatile organic compounds are shown on (Figure 4). Ground water was observed recharging the wetland east of the site at location 1. The sample at location 1 contained a number of volatile organic compounds which were present at high concentrations on the site.

Figure 5 shows inorganic compounds exceeding the acute water quality criteria levels. The highest metals and cyanide concentrations were found in the wetland east of the site, which receives run-off and ground water recharge from the site. However, other potential sources of contamination to this area were also detected.

Surface Sediments:

Surface sediment samples were collected in eleven locations during two rounds of sampling. The maximum, minimum and average concentrations are summarized in Table 1. The sampling results indicate elevated concentrations of total volatile organic compounds, total semi-volatile organic compounds, PCBS, chlordane, cadmium, chromium, and lead in the depressions directly north and east of the site. However, it was determined that other sources of contamination were also present. Figures 6 and 7 show the distribution of total volatile organic compounds, and pesticide/PCBS in sediment samples.

-7-a

Figure 4

Reprinted from "Remedial Investigation of Midwest Solvent Recovery, Inc. (Midco I), Gary, Indiana" by Environmental Resources Management-North Central

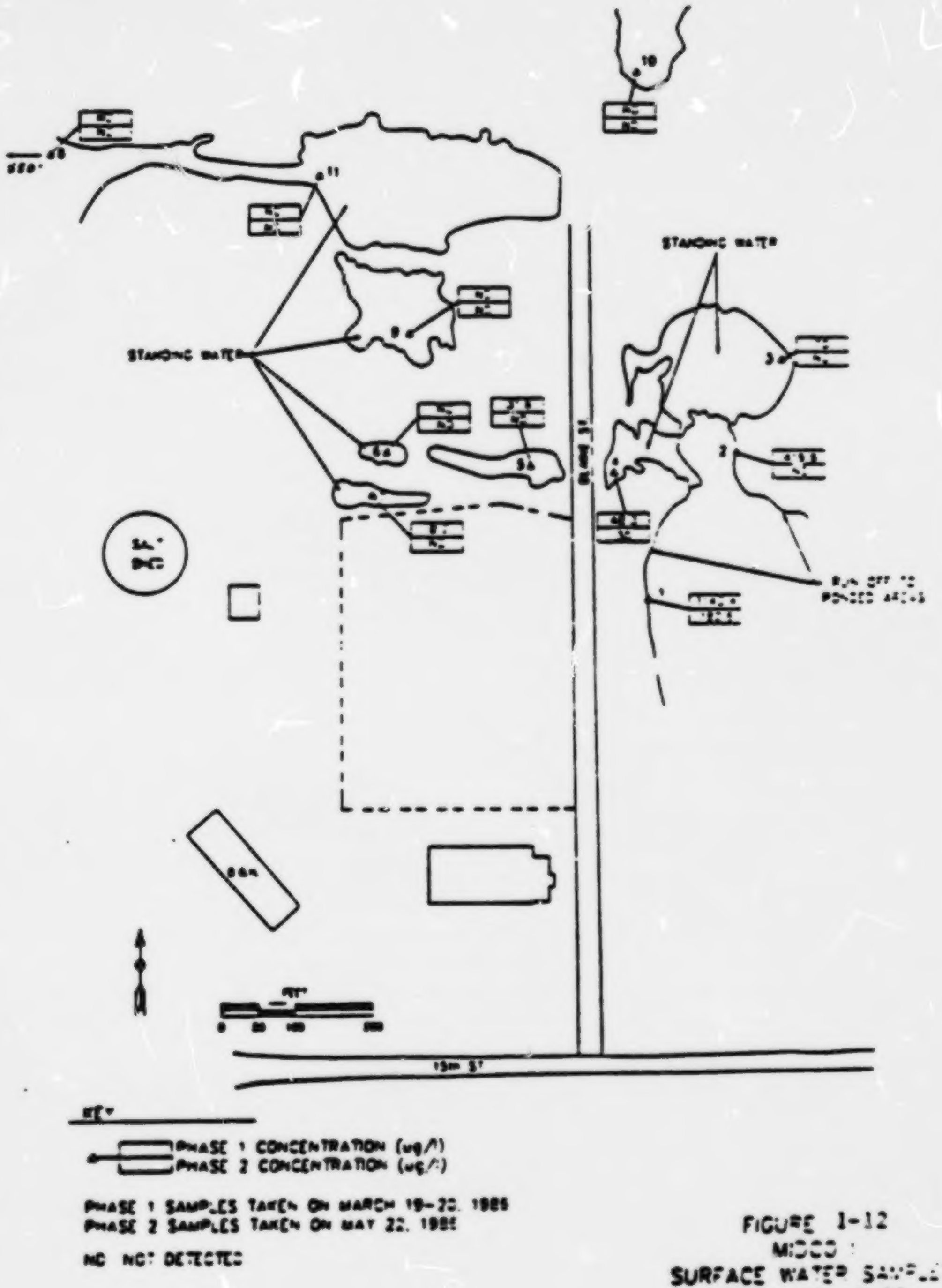

10
11
STANDING WATER
STANDING WATER
3
2
RUN OFF TO PONDED AREAS
1
15th ST
KEY
PHASE 1 CONCENTRATION (ug/l)
PHASE 2 CONCENTRATION (ug/l)
PHASE 1 SAMPLES TAKEN ON MARCH 19-20, 1985
PHASE 2 SAMPLES TAKEN ON MAY 22, 1985
ND NOT DETECTED

FIGURE 1-12
MIDCO I
SURFACE WATER SAMPLES
TOTAL VOLATILES
PHASES 1 AND 2

Reproduced from best available copy.

Figure 5

Reprinted from "Remedial Investigation of Midwest Solvent Recovery, Inc. (Midco I), Gary, Indiana" by Environmental Resources Management-North Central

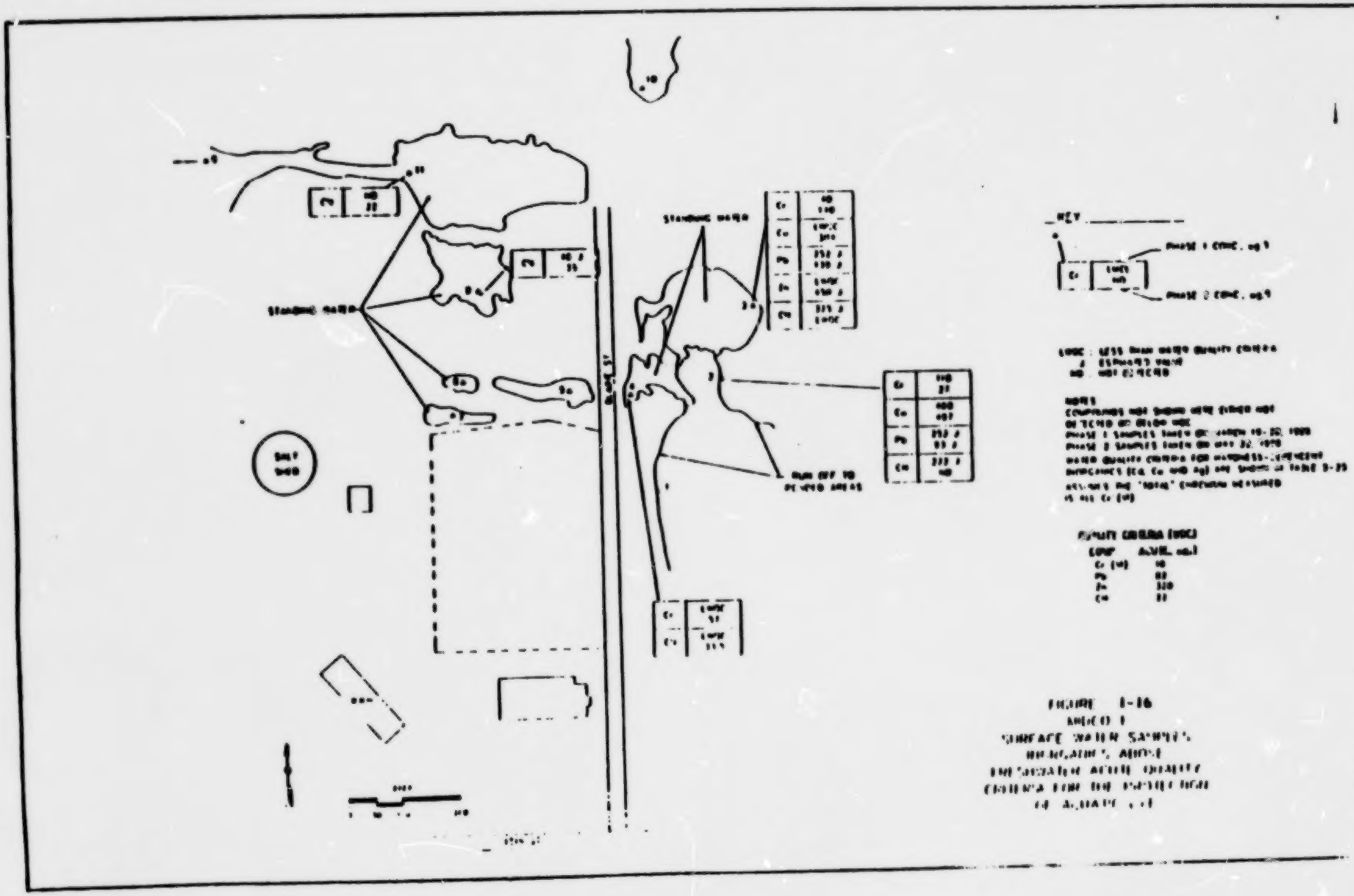

KEY
PHASE 1 CONC.
PHASE 2 CONC.
NOTES
STANDING WATER
STANDING WATER

FIGURE 1-16
MIDCO I
SURFACE WATER SAMPLES
[illegible]

-7-C.

Figure 6

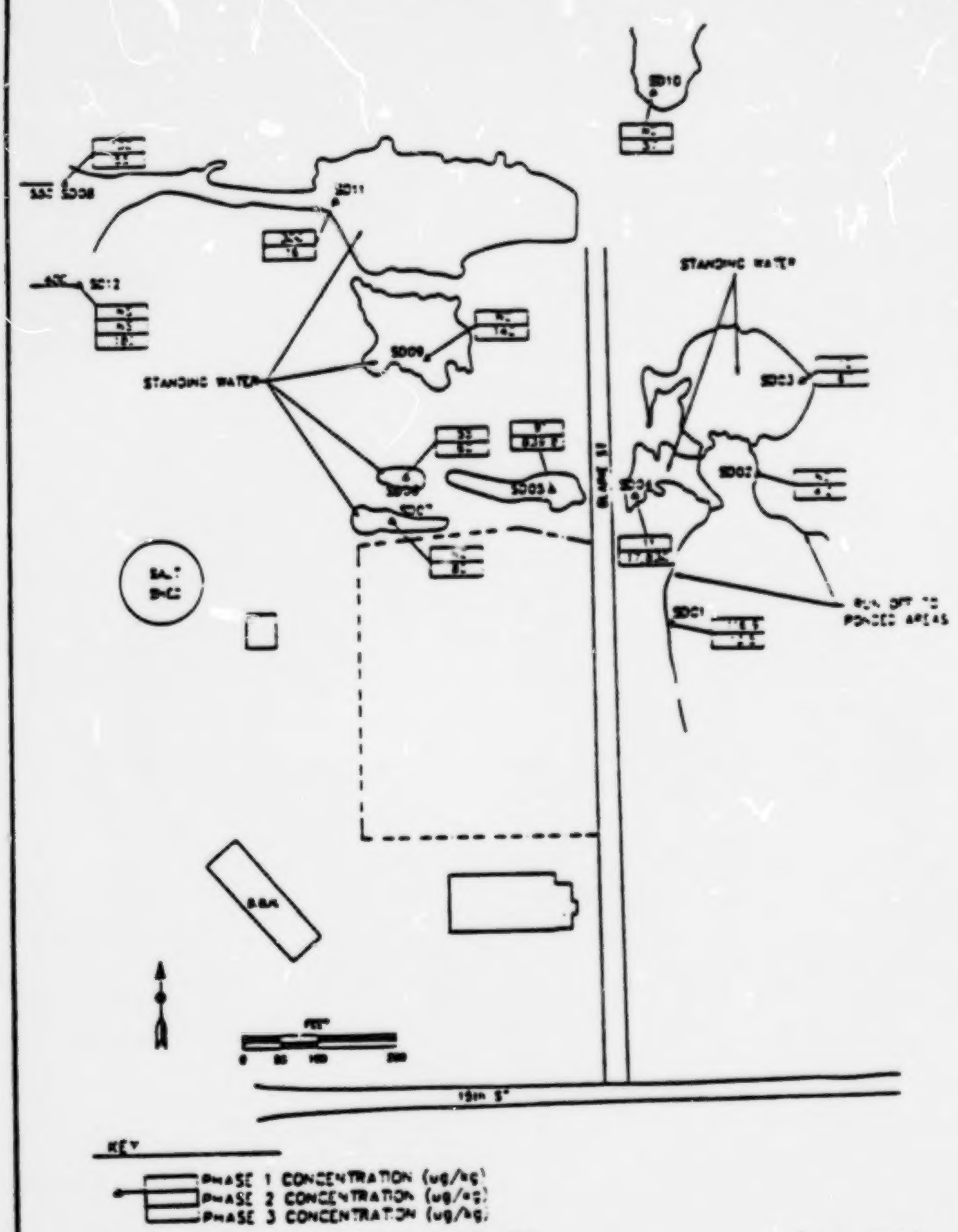

SD10
SD11
SD08
SD12
STANDING WATER
SD09
SD03
SD02
SD03A
SD07
SD01
SALT SHED
RUN OFF TO PONDED AREAS
FEET
0 50 100 200
19th ST
KEY
PHASE 1 CONCENTRATION (ug/kg)
PHASE 2 CONCENTRATION (ug/kg)
PHASE 3 CONCENTRATION (ug/kg)
PHASE 1 SAMPLES TAKEN ON MARCH 19-20 1985
PHASE 2 SAMPLES TAKEN ON MAY 22 1986
PHASE 3 SAMPLE TAKEN OF MAY 8, 1987
ND NOT DETECTED
NS NOT SAMPLED

FIGURE 1-18
MIDCO I
SEDIMENT SAMPLES
TOTAL VOLATILES
PHASES 1, 2 AND 3

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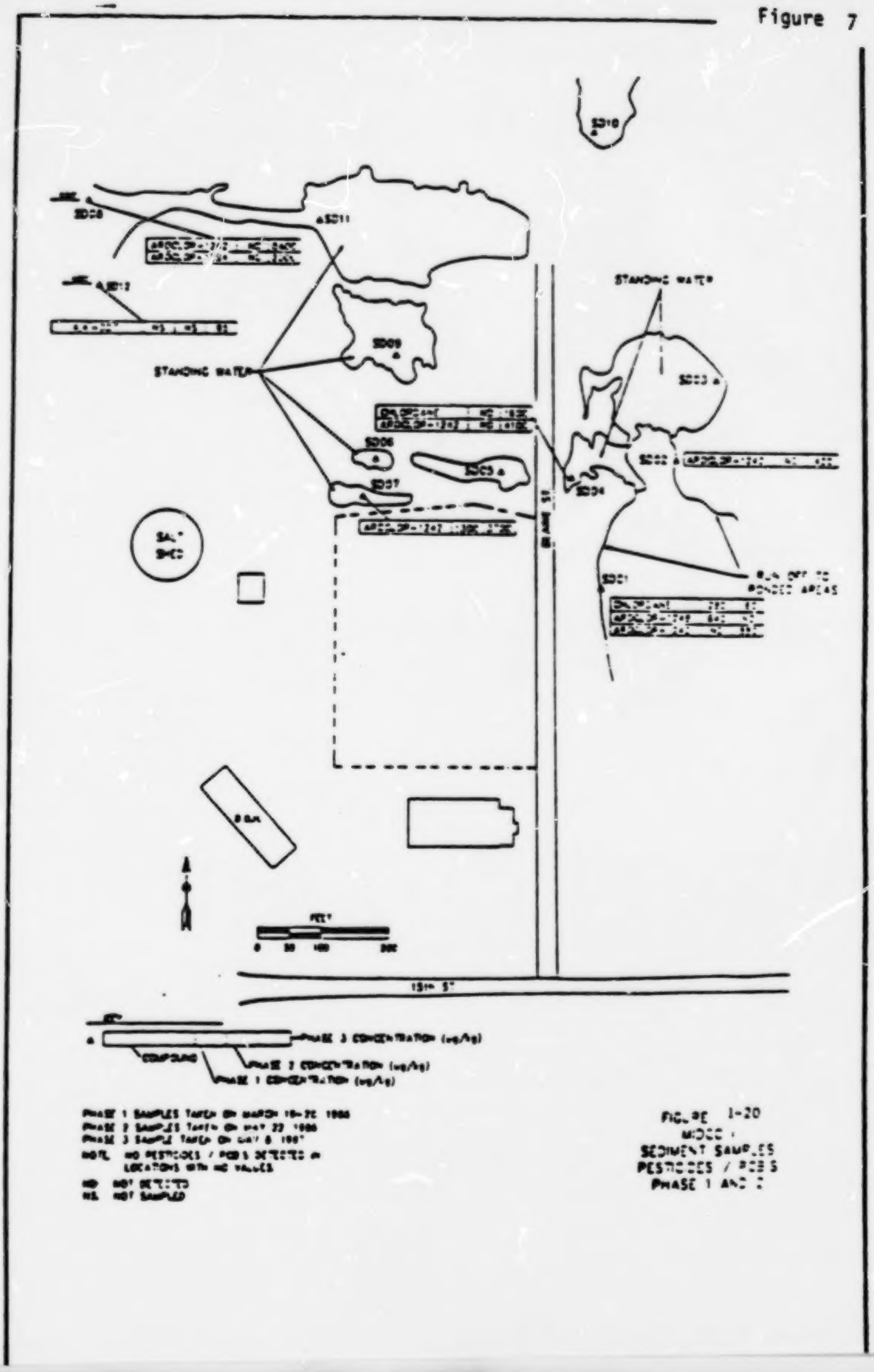
Figure 7


SD08
SD11
SD12
SD10
STANDING WATER
SD09
STANDING WATER
SD03
SD06
SD05
SD07
SD02
SD04
SD01
SALT SHED
RUN OFF TO PONDED AREAS
BRANE ST
FEET
0 50 100 200
15th ST
COMPOUND
PHASE 3 CONCENTRATION (ug/kg)
PHASE 2 CONCENTRATION (ug/kg)
PHASE 1 CONCENTRATION (ug/kg)
PHASE 1 SAMPLES TAKEN ON MARCH 19-22, 1989
PHASE 2 SAMPLES TAKEN ON MAY 22, 1989
PHASE 3 SAMPLE TAKEN ON MAY 8, 1987
NOTE: NO PESTICIDES / PCBS DETECTED IN LOCATIONS WITH NO VALUES
ND NOT DETECTED
NS NOT SAMPLED
FIGURE 1-20
MIDCO I
SEDIMENT SAMPLES
PESTICIDES / PCBS
PHASE 1 AND 2

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Ground Water:

Thirty-three monitoring wells were installed and sampled during two rounds. A limited number of wells were sampled for cyanide and a few other parameters during a third round. The maximum, minimum and average concentrations are summarized in Table 1.

An unanticipated result was the finding that the aquifer in the vicinity of Midco I is highly contaminated with salt consisting primarily of sodium and chloride. Chloride was as high as 15,000 mg/l below the site. The extent of this contamination is indicated by the chloride isolines for the 10-feet deep wells in Figure 8 and the 30-feet deep wells in Figure 9.

The Midco I RI results, as well as a study for the Ninth Avenue Dump RI, indicated that a very high concentration salinity plume is migrating from the adjacent Indiana Department of Highways (IDOH) salt storage facility. A study of aerial photographs for the Midco I RI determined that (at least from 1970-1975) an unprotected stock pile was present at the IDOH facility near a swale on the northern half of what is now the Midco I site. Presumably this stock pile was salt and the highly saline drainage from the pile drained into the swale on Midco I contributing to a salt plume from that facility. Drainage from Midco I and even bulk discharge of saline waste materials into the swale during Midco I operations could also have contributed to the salinity plume at and downgradient from Midco I.

Some of the ground water sampling results for hazardous substances are summarized in Figures 10, 11, and 12. Hazardous substances detected at high concentrations in on-site ground water compared to background include: chromium; nickel; zinc; cyanide; methylene chloride; trans-1,2-dichloroethene; chloroform; 1,1,1-trichloroethane; vinyl chloride; chloroethane; acetone; 2-butanone; 4-methyl-2-pentone; benzene; toluene; total xylene; phenol; benzoic acid; isophorone; trans-1,2-dichloroethene and 1-1 dichloroethane. The total volatile organic compound (VOC) content of the ground water samples was as high as 476,000 ug/l (MW5), but the VOCs decreased to less than 100 ug/l immediately north of the site in the 10 foot deep monitoring wells.

Elevated concentrations of methylene chloride, acetone, 2-butanone, benzoic acid, phenol, cyanide and lead were detected in off-site wells A30 and/or B30. Since there is little or no vertical gradient in the shallow aquifer in this area, it is believed that these hazardous substances were carried to the bottom of the aquifer with highly saline (and dense) water. The hazardous substances were likely from the Midco I operations.

Biota:

The U.S. Fish and Wildlife Service collected samples of fish, crayfish, snapping turtles, small mammals and earthworms near Midco I. These samples were analyzed for organic and inorganic hazardous substances. The results were compared to the results in control samples. Although the U.S. Fish and Wildlife Service has not yet issued its final report, preliminary results indicate that the following hazardous substances were

Figure 8

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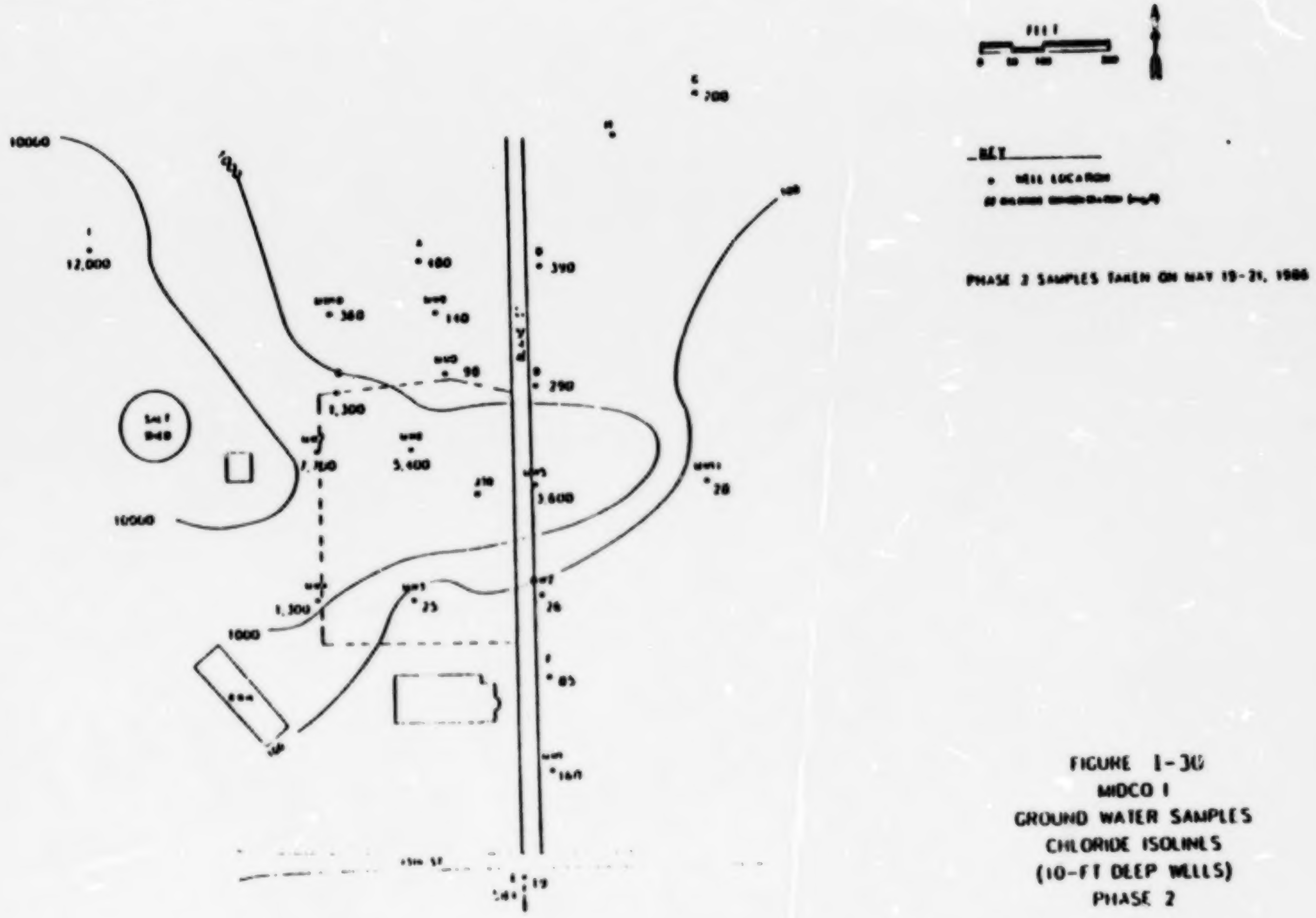

FEET
KEY
WELL LOCATION
PHASE 2 SAMPLES TAKEN ON MAY 19-21, 1986
10000
1000
12,000
380
180
110
90
390
290
1,300
7,760
5,400
3,600
28
1000
1,300
25
26
85
160
700
10000
19

FIGURE 1-30
MIDCO I
GROUND WATER SAMPLES
CHLORIDE ISOLINES
(10-FT DEEP WELLS)
PHASE 2

Figure 9

Reprinted from "Remedial Investigation of Midwest Solvent Recovery, Inc. (Midco I), Gary, Indiana" by Environmental Resources Management-North Central

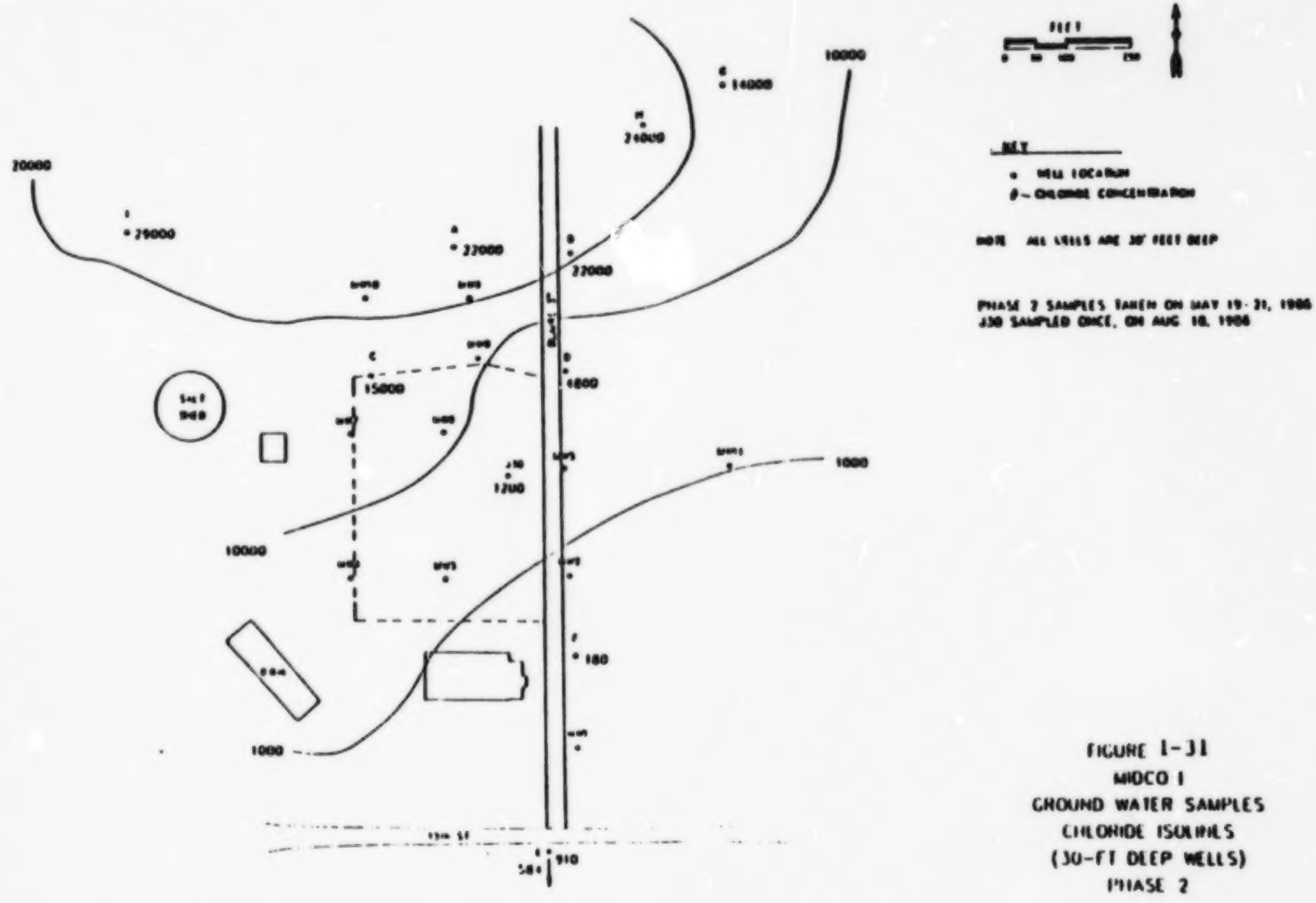
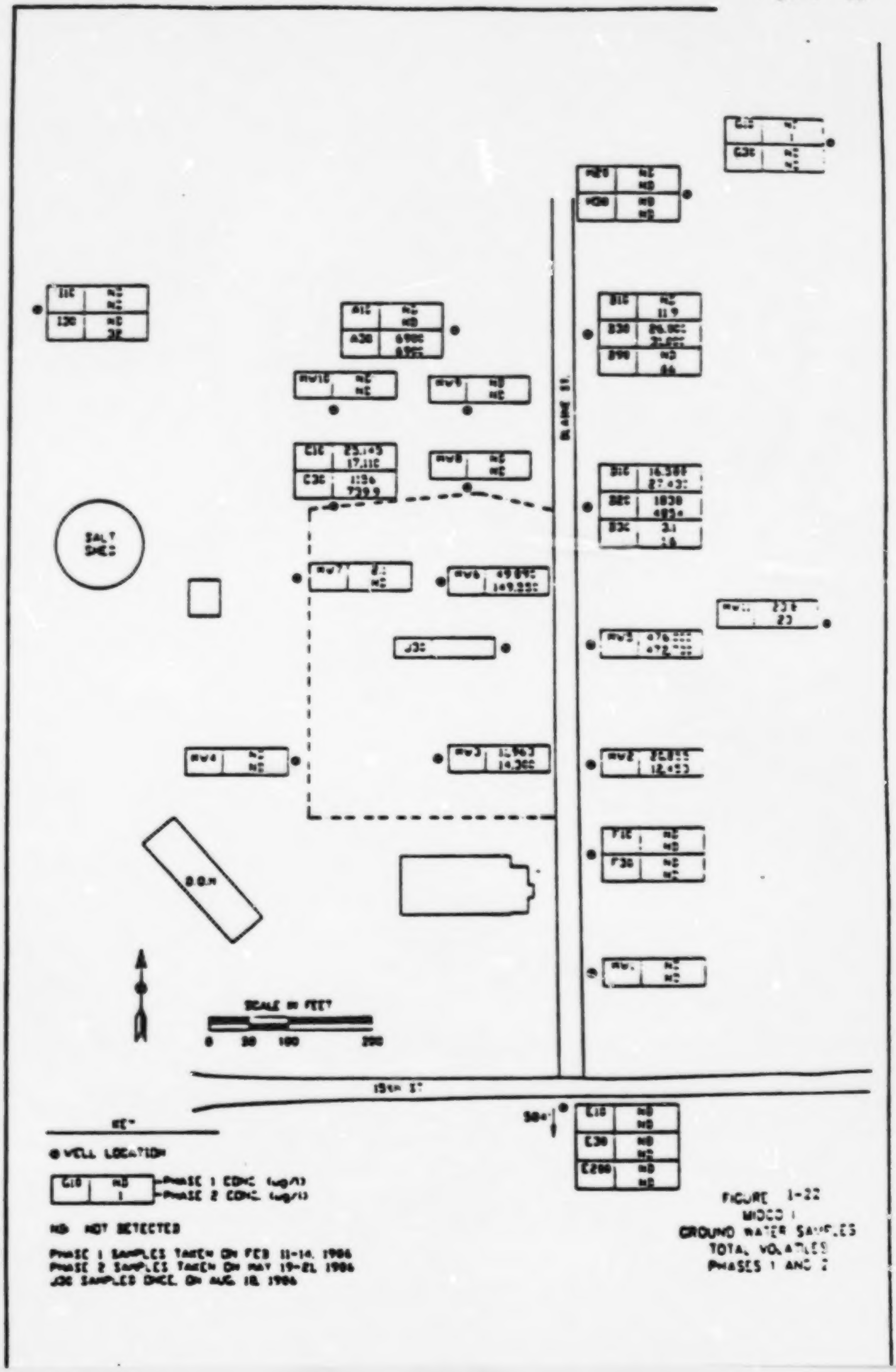

FEET
0 50 100 200
KEY
• WELL LOCATION
0 – CHLORIDE CONCENTRATION
NOTE ALL WELLS ARE 30 FEET DEEP
PHASE 2 SAMPLES TAKEN ON MAY 19-21, 1986
J30 SAMPLED ONCE, ON AUG 18, 1986
20000
29000
22000
22000
24000
14000
10000
15000
4800
1200
10000
1000
180
1000
910
584

FIGURE 1-31
MIDCO I
GROUND WATER SAMPLES
CHLORIDE ISOLINES
(30-FT DEEP WELLS)
PHASE 2

-8-b

Figure 10



BLAINE ST.
15TH ST
SALT SHED
B.O.H.
SCALE IN FEET
0 50 100 200
A1C ND ND
A3C 690C 690C
B1C ND 11.9
B3C 26,000
B9C ND 66
I1C ND ND
I3C ND 32
MW10 ND ND
MW9 ND ND
MW8 ND ND
C1C 25,145 17,110
C3C 1136 729.9
D1C 16,380
D2C 1830
D3C 3.1 1.6
MW7 ND
MW6 149,250
MW11 238 23
MW5
MW4 ND ND
MW3 11,963 14,300
MW2 12,453
F1C ND ND
F3C ND ND
J3C
G3C ND ND
H2C ND ND
H3C ND ND
50'
E1C ND ND
E3C ND ND
E20C ND ND

KEY

● WELL LOCATION

G1C | ND | 1 — PHASE 1 CONC. (ug/l) — PHASE 2 CONC. (ug/l)

ND NOT DETECTED

PHASE 1 SAMPLES TAKEN ON FEB 11-14, 1986
PHASE 2 SAMPLES TAKEN ON MAY 19-21, 1986
J3C SAMPLED ONCE, ON AUG. 18, 1986

FIGURE 1-22
MIDCO I
GROUND WATER SAMPLES
TOTAL VOLATILES
PHASES 1 AND 2

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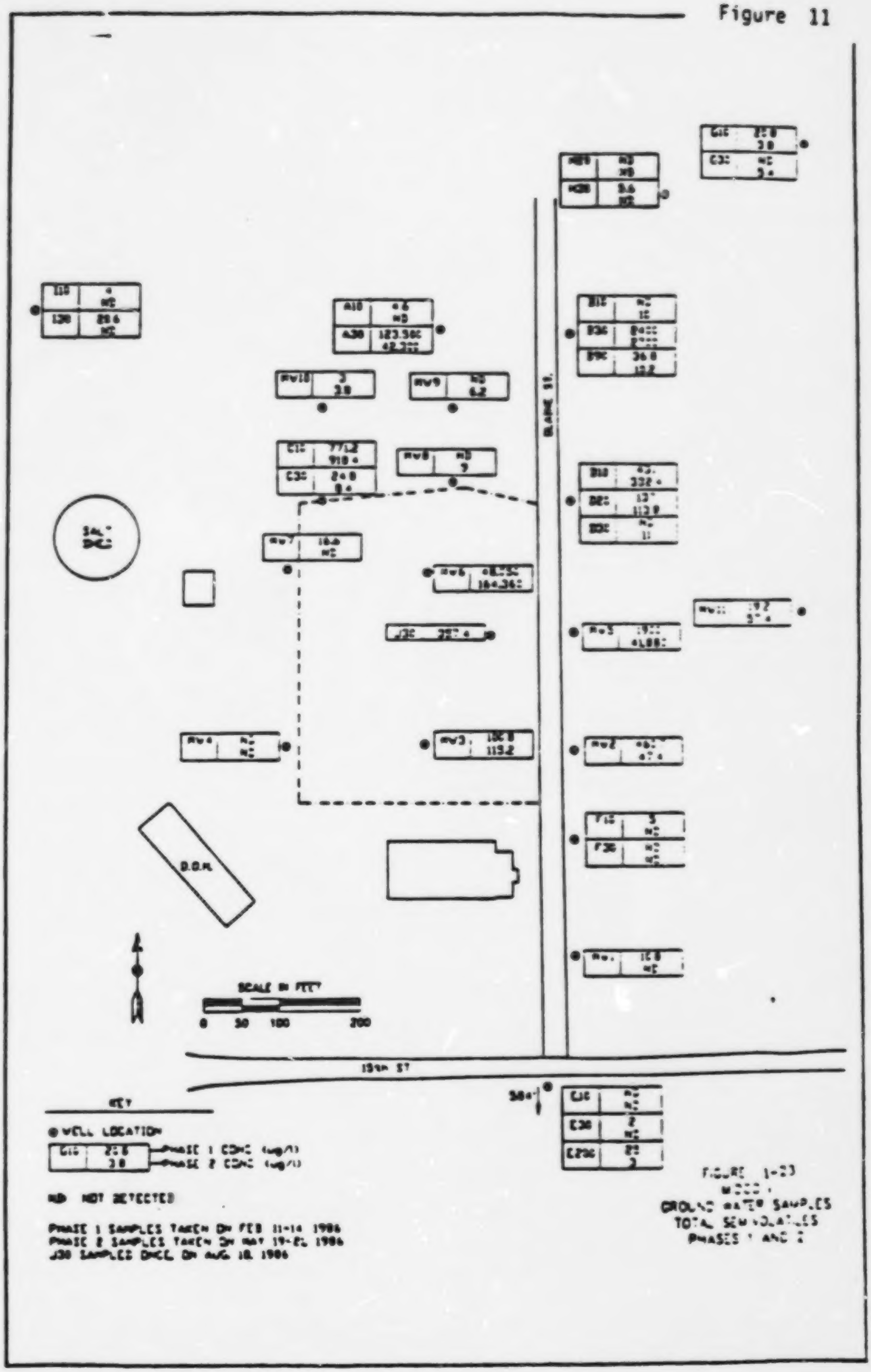
8-d

Figure 11



SALT SHED
BLAKE ST.
159th ST
D.O.H.
SCALE IN FEET
0 50 100 200
MW1
MW2
MW3
MW4
MW5
MW6
MW7
MW8
MW9
MW10
MW11
A10
A30
B10
B30
B90
C10
C30
D10
D20
D30
E10
E30
E290
F10
F30
G10
G30
H10
H30
I10
I30
J30
KEY
● WELL LOCATION
PHASE 1 CONC (ug/l)
PHASE 2 CONC (ug/l)
ND NOT DETECTED
PHASE 1 SAMPLES TAKEN ON FEB 11-14 1986
PHASE 2 SAMPLES TAKEN ON MAY 19-21 1986
J30 SAMPLED ONCE ON AUG 18 1986

FIGURE 1-23
MIDCO I
GROUND WATER SAMPLES
TOTAL SEMIVOLATILES
PHASES 1 AND 2

Reprinted from "Remedial Investigation of Midwest Solvent Recovery, Inc. (Midco I), Gary, Indiana"
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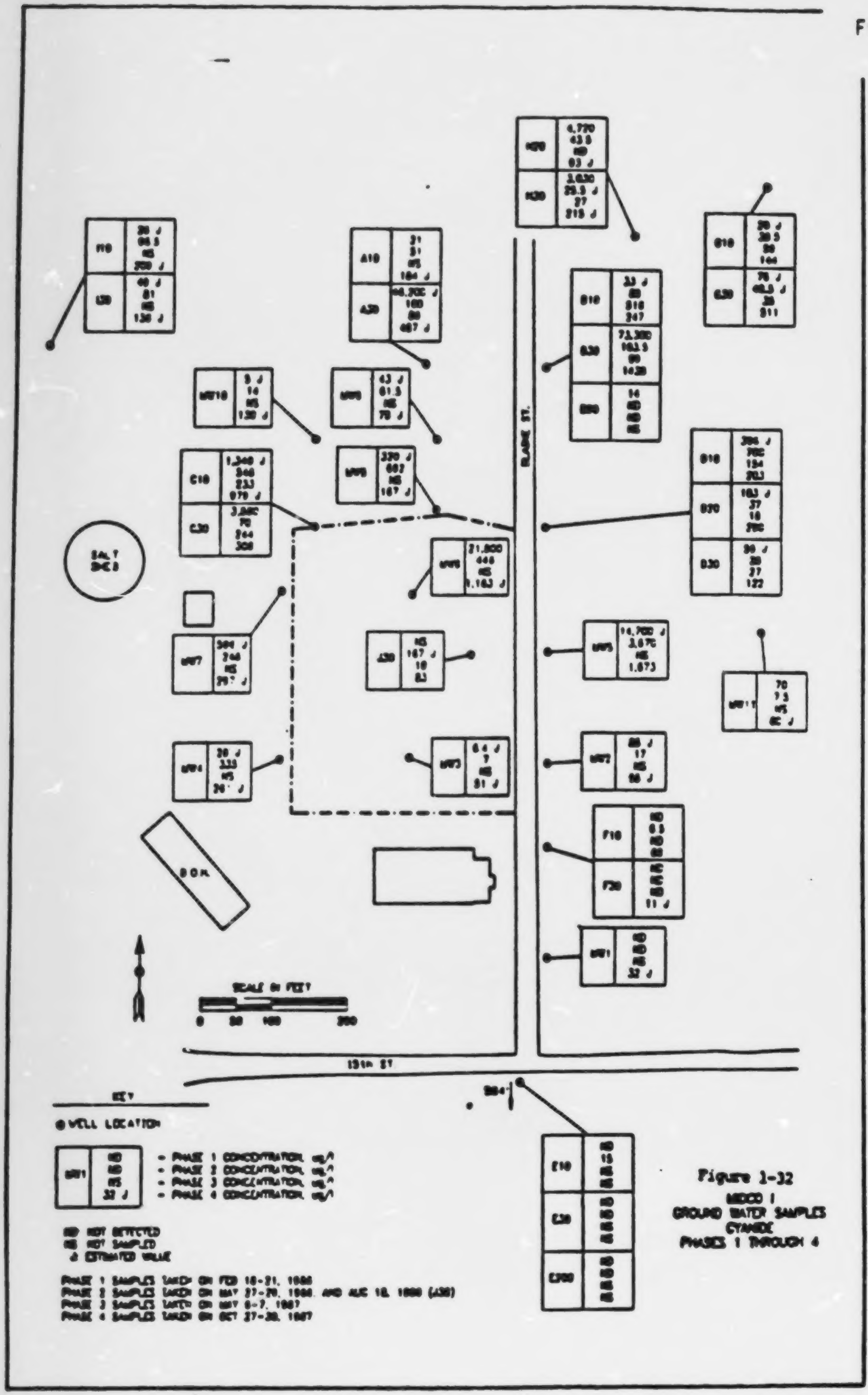
-8-e

Figure 12



SALT SHED
DOM.
BLAKE ST.
13th ST
SCALE IN FEET
0
50
100
200
KEY

● WELL LOCATION

- PHASE 1 CONCENTRATION ug/l
- PHASE 2 CONCENTRATION ug/l
- PHASE 3 CONCENTRATION ug/l
- PHASE 4 CONCENTRATION ug/l

ND NOT DETECTED
NS NOT SAMPLED
J ESTIMATED VALUE

PHASE 1 SAMPLES TAKEN ON FEB 18-21, 1986
PHASE 2 SAMPLES TAKEN ON MAY 27-29, 1986, AND AUG 18, 1986 (J30)
PHASE 3 SAMPLES TAKEN ON MAY 6-7, 1987
PHASE 4 SAMPLES TAKEN ON OCT 27-28, 1987

Figure 1-32
MIDCO I
GROUND WATER SAMPLES
CYANIDE
PHASES 1 THROUGH 4

frequently detected at elevated concentrations relative to the control samples:

2-butanone	aluminum
Toluene	copper
ethylbenzene	lead
xylene	silver

With the exception of aluminum and silver, these hazardous substances were also elevated in the source, ground water or surface water and sediments at Midco I (compared to controls).

VI. SUMMARY OF SITE RISKS

For a future development scenario including usage of the ground water, soil ingestion and air exposure, an estimate of the health risks is as follows:

	Lifetime Cumulative Carcinogenic Risk*	Cumulative Non-carcinogenic Risk Index*
Exposure to ground water	4.1×10^{-2}	86
Exposure to soils	6.8×10^{-5}	3.6
Exposure to future surface water	2.2×10^{-6}	0.0039

* Risks from exposure to ground water and soils are from Table 4-22 of the Addendum to Public Comment Feasibility Study, Midco I, March 7, 1989 (excluding arsenic which is at background). Risk from exposure to surface water is from Appendix A of the Public Comment Feasibility Study, February 10, 1985.

The main compounds causing the carcinogenic risks are:

Ground water - methylene chloride, vinyl chloride, benzene;

Soils - PCBs, bis (2-ethylhexyl) phthalate, tetrachloroethane, methylene chloride, dieldrin trichloroethene; and benzo(a) pyrene;

Surface Water - vinyl chloride, and methylene chloride.

The main compounds causing the non-carcinogenic risks in ground water are: methylene chloride, 4-methyl-2-pentanone, 2-butanone, phenol, nickel, chromium (as Cr(V1)), chloroform, and acetone.

The following hazardous substances were detected at concentrations above the Primary Drinking Water Regulation Maximum Contaminant Levels (MCLs)

(40 CFR 41) in ground water near the site: trans-1,2-dichloroethane; trichloroethene; 1,2-dichloroethane; benzene; toluene; ethylbenzene; vinyl chloride; halogenated methanes; selenium; cadmium; barium; and chromium.

A cumulative subchronic hazard index for an on-site future development scenario was calculated to be 63. This was calculated by adding the ratios of the estimated subchronic exposure rate (SER) to the Acceptable Subchronic Intake (ASI) for each chemical. The index exceeded unity (or one) for all age groups for nickel, toluene and 2-butanone. If the index is less than one, no adverse health effects would be expected. In addition, the index exceeded unity for pica children for lead, cyanide (assumed HCN), and bis(2-ethylhexyl) phthalate (Remedial Investigation of Midwest Solvent Recovery (Midco I). December 1987. pp 6-58, 6-59 and Table 6-20).

For the nearest off-site residents, the lifetime cumulative cancer risk was estimated to be 5.7 x 10^{-5}, mainly due to benzene emissions to air and ingestion of arsenic and benzo(a)pyrene in soils north of the site. However, the concentration of arsenic in these soils was below the average detected in background samples (Remedial Investigation of Midwest Solvent Recovery (Midco I). December 1987. p-6-61 and Table 6-22).

If no action is taken to contain or recover the ground water, contaminants will continue to migrate from the site in the ground water. The contaminated ground water is predicted to affect the area shown in Figure 13, and could affect up to 19 residential wells (some of which are used for drinking) in the Calumet aquifer. It will also affect the surrounding wetlands.

Alternatively, the contaminated ground water could discharge to the sewer north-northeast of the site (if it is leaking), flow through the City of Gary Wastewater Treatment Plant, discharge to the Grand Calumet River and eventually reach Lake Michigan.

It has been argued that the Calumet aquifer at Midco I should be considered a Class III aquifer because of the high salinity, and, therefore, that the aquifer should not be protected for drinking water usage. However, because the salinity is not natural and has only affected a limited portion of the aquifer and because the ground water in the bulk of the aquifer is of drinking water quality and indeed is used as a drinking water source a short distance from the site, U.S. EPA has determined that the Calumet aquifer in the vicinity of Midco I is a Class II aquifer and should be protected for drinking water usage.

It has also been argued that there should be considered no risk due to future drinking water usage of the ground water because the high salinity would prevent its usage. However, there is no assurance that the contaminants from the site will always migrate within the salinity plume. In fact, Figures 8 and 9 show that only a small portion of the ground water below the site has a total dissolved solids content greater than 10,000 mg/l, which is the concentration used in the U.S. EPA Underground

-10-a

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Figure 13

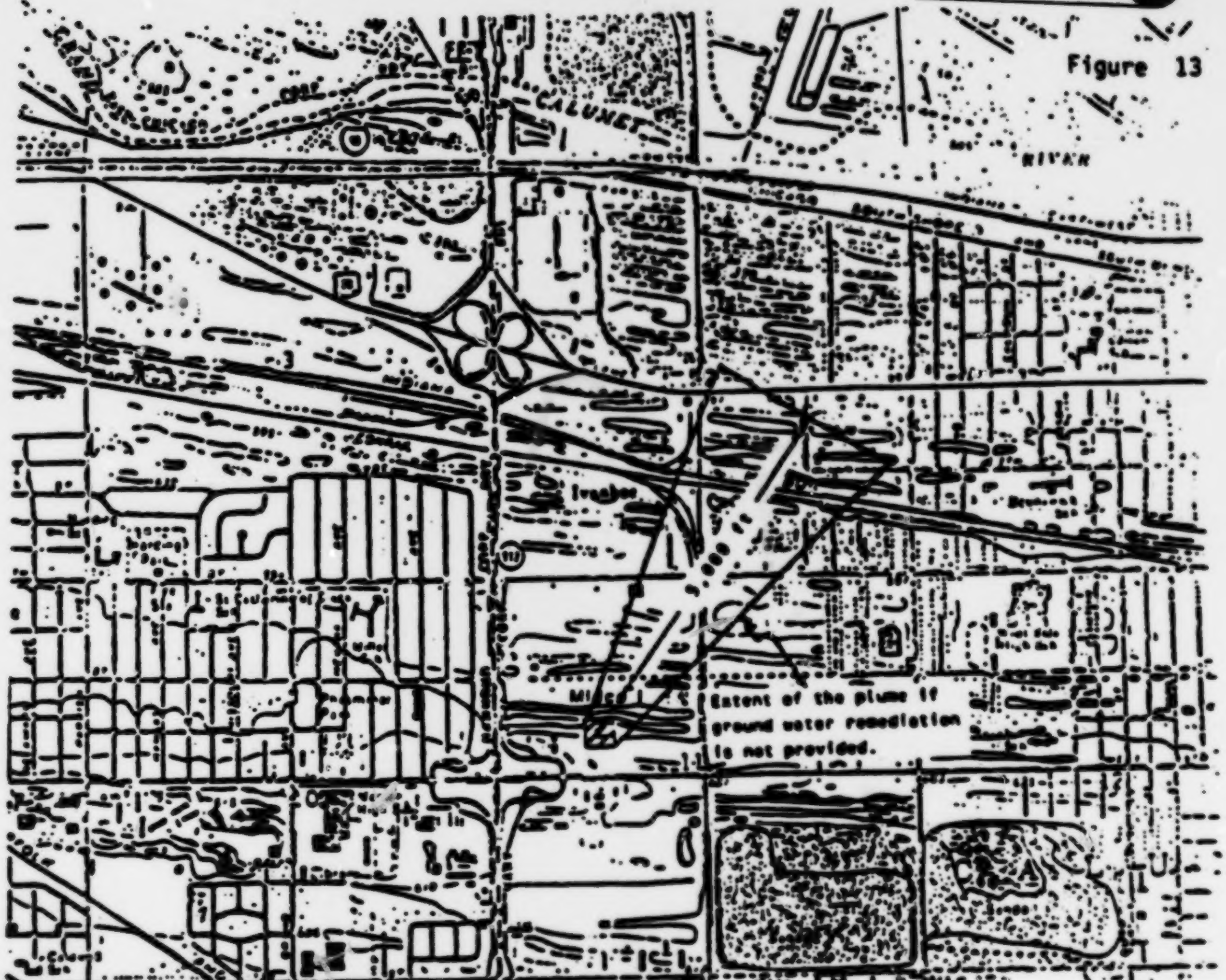

CALUMET
RIVER
Extent of the plume if ground water remediation is not provided.
15
13
N
Indiana
0
2000
Scale in Feet

FIGURE 1-37
MIDCO I
EXTENT OF PLUME IF GROUND WATER REMEDIATION NOT PROVIDED

Injection Control Program as the cut-off point for drinking water usage. In addition, the Midco I operation contributed an undeterminable amount of the ground water salinity problem at and downgradient from the site.

The following parameters exceeded the chronic and, for some, also the acute water quality criteria for protection of aquatic life in some surface water samples: diethylphthalate, di-n-butylphthalate, cadmium, chromium copper, iron, lead, mercury, nickel, silver, zinc and cyanide. The U.S. Fish and Wildlife Service believes that the biota living in the vicinity of Midco I accumulated elevated concentrations of volatile and inorganic compounds, which adversely affected fish and wildlife resources.

VIII. DESCRIPTION OF ALTERNATIVES

A large number of alternatives were screened, using engineering judgement for applicability, past performance and implementability. Detailed evaluations were conducted for 14 alternatives, which are combinations of the most promising technologies. These technologies can be categorized as follows:

Containment:

- multilayered cap
- slurry wall

Ground Water Treatment:

- pumping of contaminated ground water and disposal in an underground injection well without treatment
- pumping of contaminated ground water, treatment and then disposal in an underground injection well
- pumping of contaminated ground water and treatment by evaporation

Source Treatment:

- soil vapor extraction
- solidification/stabilization
- in-situ vitrification
- incineration

Alternatives providing for direct treatment or removal of contaminated soils below the water table were eliminated for a number of reasons. For one, treatment of soils below the water table would normally require dewatering of the aquifer below the site prior to excavation. Dewatering would require installation of a containment barrier and disposal of a large volume of contaminated ground water. Because of the time needed for the injection well construction, the contaminated ground water for dewatering would have to be commercially disposed of. The nearest commercial deep well is in Ohio, so this disposal would be expensive and add transportation hazards. In addition, ground water pump and treatment alternatives may address readily leachable contaminants by gradual removal by natural ground water flushing. Contaminants that do not leach out would normally not be available for direct ingestion because they are below the water table. Therefore, the source removal and treatment alternatives only address contaminated subsurface soils and materials above the water table, and highly contaminated materials below the water table that can be handled by localized dewatering.

The areal extent and depth of source treatment above the water table will be determined by soil cleanup action levels (CALs). The extent and period of operation of ground water treatment measures will be determined by ground water CALs. Surface sediments will be scraped up in the areas shown in Figure 14 to a depth that will leave the remaining sediments below the soils CALs. The CALs are defined in Section X, and includes attainment of MCLs in the ground water. The expected areal extent of source and surface sediment remediation required is shown in Figure 14. The expected areal extent of ground water remediation is shown in Figure 15. Applicable, or relevant and appropriate requirements (ARARs) for the various alternatives are summarized in Tables 6, 7 and 8 in the Appendix. The fourteen alternatives are summarized below, including the status of compliance with major ARARs:

Alternative 1: No Action

By law, U.S. EPA is required to consider the no-action alternative. No action would be taken to address the source, the contaminated ground water or surface water. The source would continue to cause contamination of the ground water and surface waters. The contaminated ground water would continue migrating off-site and may eventually affect nineteen ground water wells.

Alternative 2: Access Restrictions With Cap

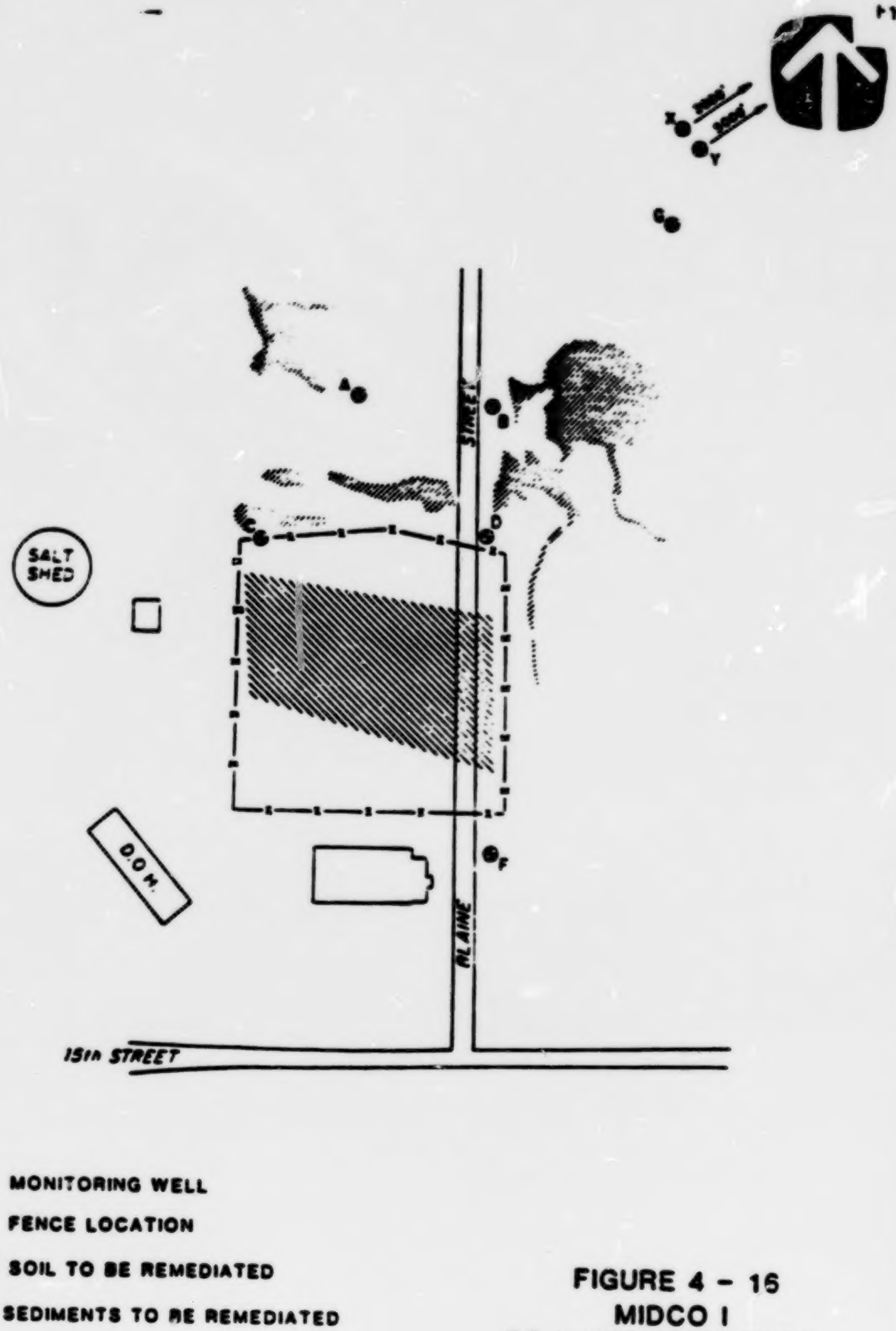
This alternative consists of the construction of a RCRA compliant multi-layer cap over the entire site, an area of approximately 150,000 square feet. The cap would include a low-permeability barrier layer to prevent vertical migration of water, a lateral drainage layer and a vegetative cover, as shown in Figure 16.

The scraped contaminated sediments (estimated to be 1,200 cubic yards) would be excavated and transported to an off-site landfill for disposal.

Ground water use restrictions would be placed in the area shown in Figure 13. The nineteen current users of the ground water in the Calumet aquifer in that area (both domestic drinking and non-drinking) would be connected to the municipal water system.

- 12-a

Figure 14


X
3000'
3000'
Y
G
A
B
STREET
C
D
SALT SHED
D.O.M.
F
BLAINE
15th STREET

KEY:

● MONITORING WELL

-I—I- FENCE LOCATION

▨ SOIL TO BE REMEDIATED

░ SEDIMENTS TO BE REMEDIATED

0 100 200 300

SCALE IN FEET

FIGURE 4 - 16
MIDCO I
SOIL AND SEDIMENTS
TO BE REMEDIATED

-12-6

Figure 15

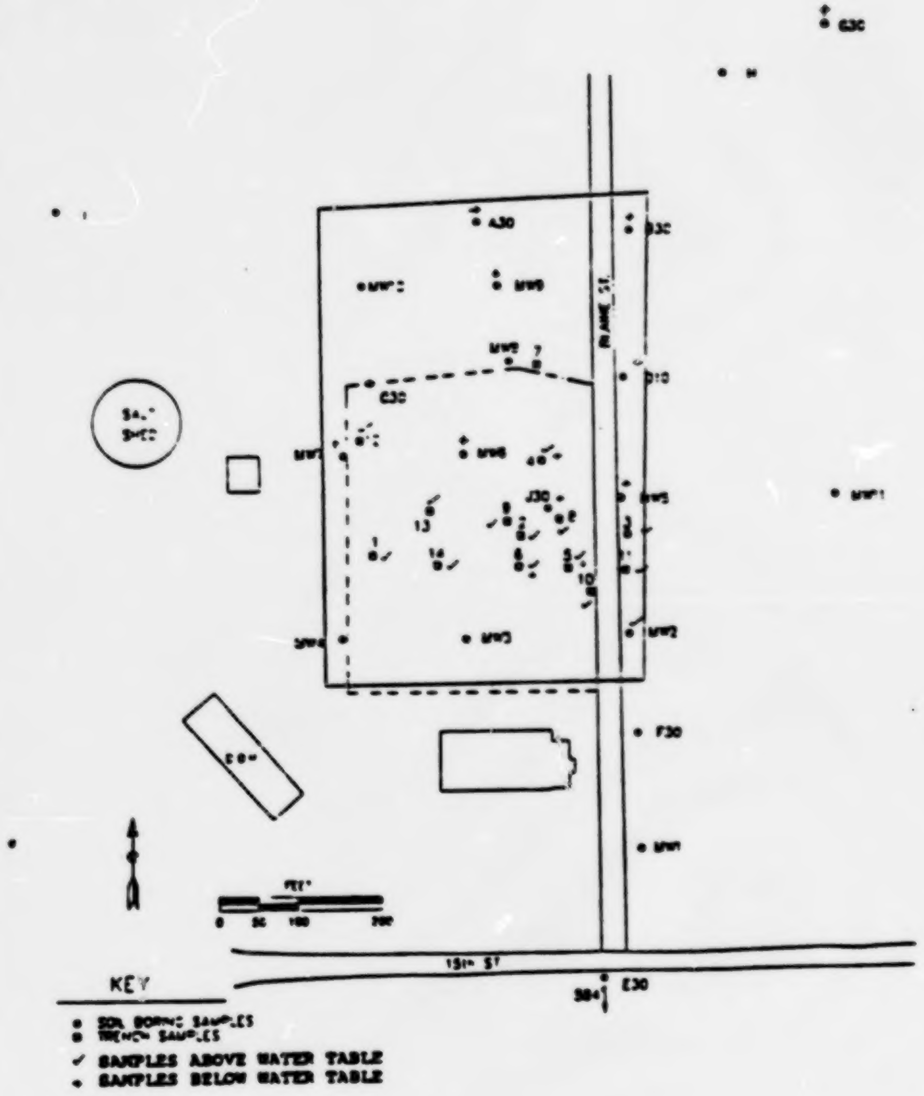

G30
H
A30
B30
MW8
MW9
FRANKE ST.
7
D30
SALT SHED
C30
MW7
MW6
J30
MW5
MW1
13
1
14
10
MW4
MW3
MW2
F30
MW1
FEET
0 50 100 200
15th ST
E30
KEY
● SOIL BORING SAMPLES
● TRENCH SAMPLES
✓ SAMPLES ABOVE WATER TABLE
• SAMPLES BELOW WATER TABLE

FIGURE 1-35

NIDCO I
GROUND WATER TO BE REMEDIATED

-12-C

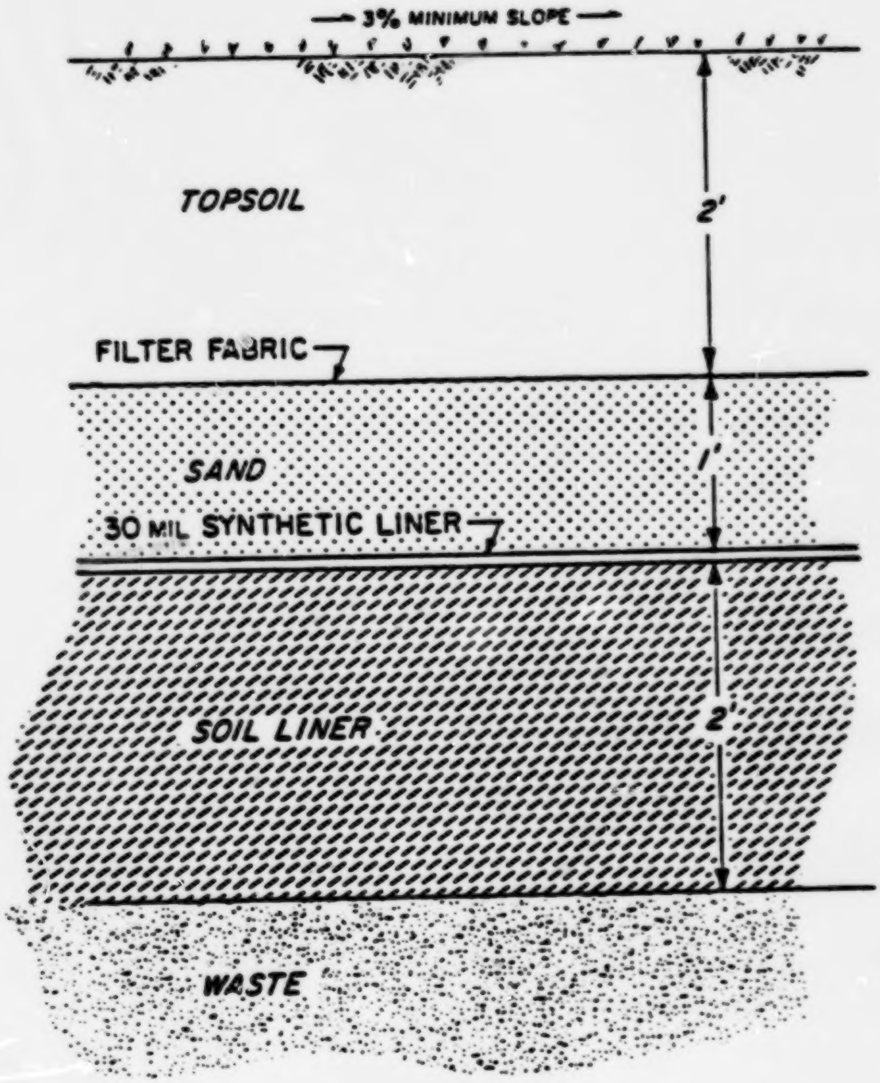

3% MINIMUM SLOPE
TOPSOIL
2'
FILTER FABRIC
SAND
1'
30 MIL SYNTHETIC LINER
SOIL LINER
2'
WASTE

FIGURE 4-2
MIDCO I
ALTERNATIVE 2
RCRA MULTILAYERED CAP

This and all the remaining alternatives would include installation of a six foot chain link fence with 3-strand barbed wire around the site, installing warning signs, and imposition of deed restrictions.

Ground water and surface water migration would be monitored regularly.

1. Relevant and Appropriate Requirements:

This alternative would be consistent with hazardous waste landfill closure requirements of the Resource Conservation and Recovery Act (RCRA) (40 CFR 264.111, 264.116, 264.117, 264.310), and ground water monitoring requirements of RCRA (40 CFR 264.97, and 264.99). However, it would not be consistent with the Primary Drinking Water Regulations (40 CFR 141) or the RCRA corrective action requirements (40 CFR 264.100) because contamination from the site would continue to cause exceedance of the MCLs in off-site ground water. It also would not be consistent with the Ambient Water Quality Criteria (AWQC) for protection of aquatic life, because the contaminated ground water would recharge surface waters and cause exceedance of the AWQC.

2. Applicable Requirements:

The off-site disposal of contaminated sediments would have to be in compliance with U.S. EPA's off-site policy and all applicable RCRA, and Department of Transportation (DOT) regulations.

Alternative 3: Containment

A clay slurry wall would be installed around the area where clean-up action levels (CALs) are exceeded in soils above the water table and for ground water. The wall would be keyed into the material confining layer located 30 feet below the site, and would be approximately 36 inches wide and 2,050 feet long.

Because of the high salt content and other contaminants at the site, bench scale tests would be performed in order to determine the formulation for the slurry. Bentonite clay may be affected by the high salinity, so attupulgite clay may be used instead.

A multi-layer cap as described in Alternative 2 would be placed over the area inside the slurry wall. Contaminated surface sediments would be scraped and contained within the cap and slurry wall. An extraction well would be placed in the containment area to lower the ground water inside the wall by approximately 0.5 feet to insure an inward ground water gradient. Initially, this would require disposal of approximately 21,500 gallons of contaminated ground water. This would be disposed of in the nearest commercial deep well.

As with Alternative 2, the site would be fenced and posted, deed restriction imposed, and a monitoring program implemented.

1. Relevant and Appropriate Requirements:

This alternative would be consistent with RCRA hazardous waste landfill closure requirements. Because the ground water outside the slurry wall would meet the CALs, this alternative would be consistent with RCRA corrective action requirements, and the Primary Drinking Water Regulations. After containment of the Midco I source, surface water would shortly meet the AWQC (unless other sources are present).

2. Residual Risks:

Because no treatment is involved in this alternative, the residuals contained within the slurry wall and cap would be the same as presently at the site. The risks involved in case the cap and slurry wall are damaged or if residential development occurred on the site, would be the same as the present site risks.

Alternative 4A: Ground Water Pumping and Deep Well Injection

This and all other alternatives treating the ground water includes installation and operation of ground water extraction wells to intercept the contaminated ground water that exceeds the CALs. The results of a preliminary model estimated that seven extraction wells should be installed to recover ground water as shown in Figure 17. The total estimated pumping rate for the seven wells is 13 gpm. The extraction wells would be operated until ground water CALs are met in all portions of the Calumet aquifer affected by the site. Because the contaminated ground water would be contained, AWQC would shortly be attained in surface water, unless prevented by other sources.

A Class I hazardous waste underground injection well would be installed. The injection zone would be located approximately 2,250 feet below the surface in the Mount Simon aquifer. The underground injection operation may be combined with the Midco II remedial action if this is determined to be cost effective. The 9th Avenue Dump remedial action may also include utilizing the deep well from Midco for disposal of saline waste water. In these cases, the combined treatment and disposal activities will constitute an on-site action for purposes of the off-site policy, with the exception that the transported wastes must be manifested.

The combined treatment and disposal can be considered an on-site action pursuant to Section 104(d)(4) of CERCLA because the following criteria are met (Interim RCRA/CERCLA Guidance on Non-Contiguous Sites and On-site Management of Waste and Treatment Residue. Porter. March 27, 1986. OSWER Directive 9347.0-01):

1. The sites are close together;
2. The wastes are compatible;
3. The wastes will be managed as part of a highly reliable long-term remedy;

Figure 17

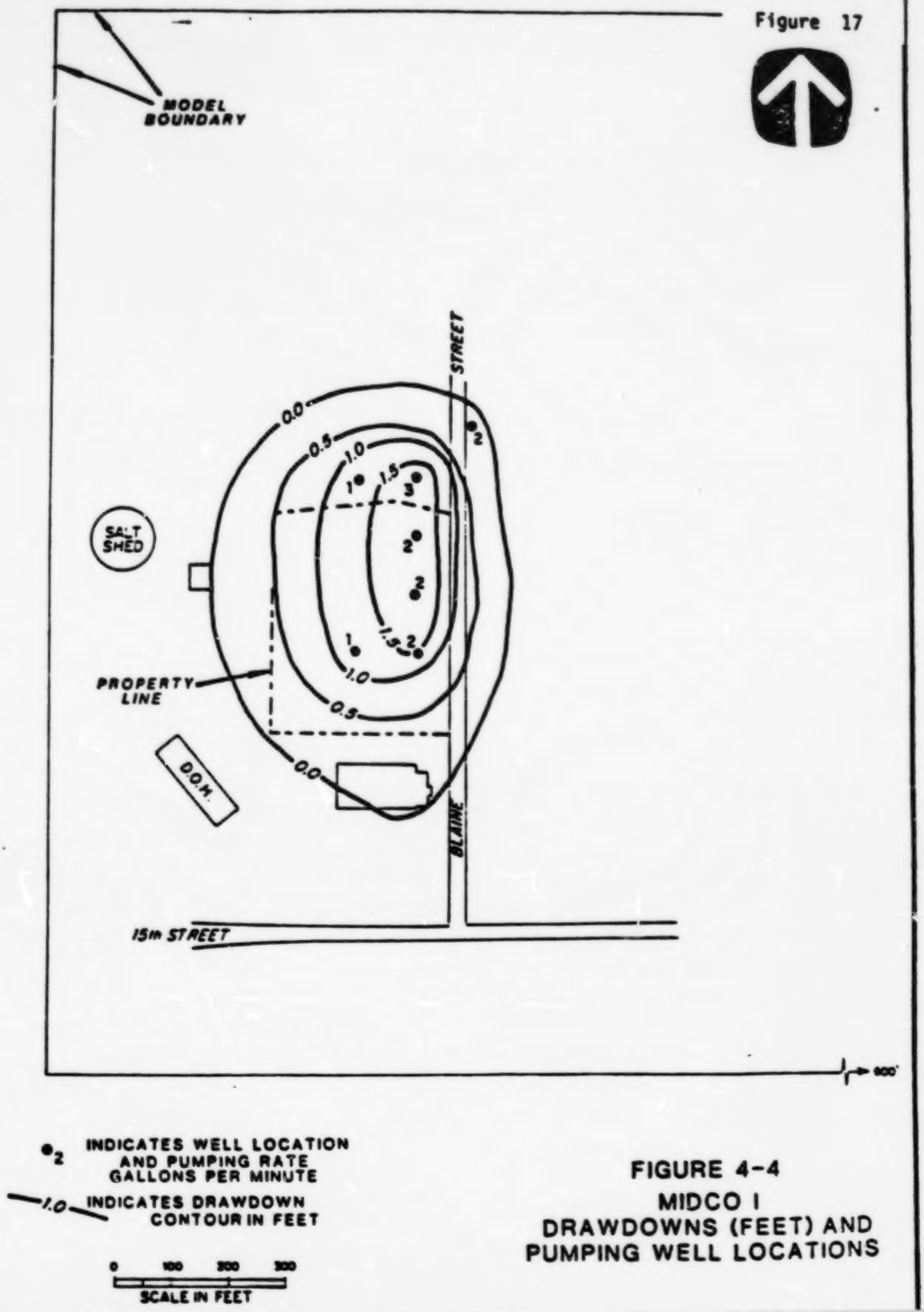

MODEL BOUNDARY
SALT SHED
PROPERTY LINE
D.O.M.
BLAINE STREET
15th STREET
0.0
0.5
1.0
1.5
1
3
2
2
2
1
2
800'
●2 INDICATES WELL LOCATION AND PUMPING RATE GALLONS PER MINUTE
1.0 INDICATES DRAWDOWN CONTOUR IN FEET
0
100
200
300
SCALE IN FEET

FIGURE 4-4
MIDCO I
DRAWDOWNS (FEET) AND
PUMPING WELL LOCATIONS

4. The incremental short-term impacts to public health and the environment will be minimal.

1. Applicable Requirements:

The deep well injection must be in compliance with the Land Disposal Restriction (LDR) requirements of 40 CFR 268 and 40 CFR 148. The following listed hazardous wastes have been disposed of on the site and are contained in the contaminated subsurface soils, ground water and surface sediments: F001, F002, F003, F005, F007, F008, F009.

For this reason, before the ground water can be injected without treatment, a petition to allow land disposal of waste prohibited under Subtitle C of 40 CFR 268, must be granted by the U.S. EPA Administrator pursuant to 40 CFR 268.6 and 40 CFR 148 Subpart C. This petition must demonstrate that there will be no migration of hazardous constituents from the injection zone for as long as the wastes remain hazardous.

A cross section of the geology of this area is shown in Figure 18. The injection zone in the Mount Simon aquifer is separated by geological formations from drinking water aquifers. Nearby class I underground injection wells that are presently operating, have submitted petitions pursuant to 40 CFR 268.6. These petitions are presently under review by U.S. EPA.

The injection well must be constructed, installed, tested, monitored, operated, closed and abandoned in accordance with U.S. EPA requirements and conditions pursuant to 40 CFR 144, and 146. In addition, reporting requirements must be in accordance with 40 CFR 144 and 146. Contaminated surface sediments will be scraped and disposed of off-site in accordance with the U.S. EPA off-site policy and applicable RCRA and DOT requirements.

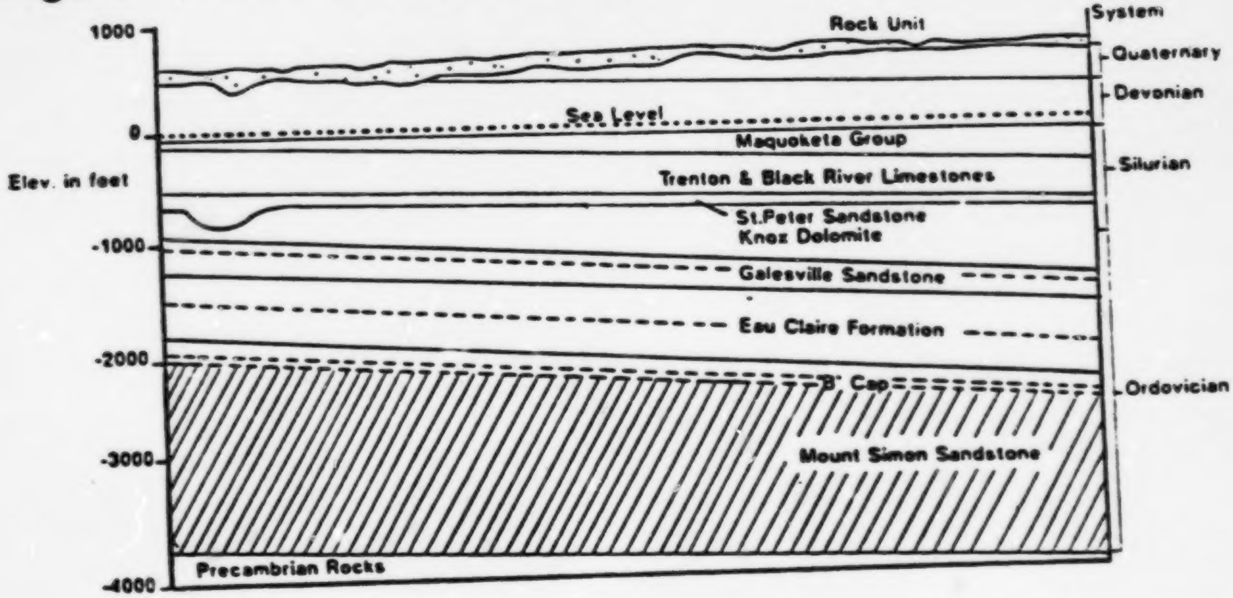
The remedial action may also require responses to operational problems, and implementing corrective actions pursuant to 40 CFR 146.64, 144.67, 144.12, 144.51(d) and 144.55. This could include requirements for construction, monitoring, reporting, well plugging, and injection well closure as necessary to prevent movement of any contaminant into an underground source of drinking water (U.S.D.W.) (40 CFR 144.3), due to operation of the injection well. This may also require implementation of remedial actions to restore any U.S.D.W., that becomes contaminated as a result of the operation of the underground injection well, to background water quality to the extent practical, pursuant to Section 3004(u) and 3008(h) of the 1984 Hazardous and Solid Waste Amendments.

2. Residual Risks and Ralevant and Appropriate Requirements:

Natural attenuation and flushing of the source would occur during operation of the ground water extraction system. However, some hazardous substance residuals would remain in the subsurface soils. The residual risks cannot be determined at this time. Therefore, a site cover would

Figure 18

Figure 7, Lake County Geology


Rock Unit
System
1000
Quaternary
Devonian
Sea Level
0
Maquoketa Group
Silurian
Elev. in feet
Trenton & Black River Limestones
St.Peter Sandstone
Knox Dolomite
-1000
Galesville Sandstone
Eau Claire Formation
-2000
"B" Cap
Ordovician
-3000
Mount Simon Sandstone
Precambrian Rocks
-4000

be placed over the contaminated soils that would be consistent with RCRA hazardous waste landfill closure requirements (40 CFR 264.111, 264.116, 264.117, 264.310). The site would be fenced, deed restrictions imposed, and a ground water monitoring system implemented consistent with RCRA requirements.

Alternative 4C: Ground Water Pumping, Treatment and Either Deep Well Injection or Reinjection into the Calumet Aquifer

This alternative could be the same as alternative 4A except that the contaminated ground water would be treated to the extent necessary to meet U.S. EPA requirements prior to the deep well injection. For this alternative, U.S. EPA approval of the underground injection well would be required, but no petition demonstration would be needed.

Prior to the deep well injection, Land Disposal Restriction (LDR) treatment standards would be met, for listed wastes F001, F002, F003, and F005 (40 CFR 268), this would likely require an air stripper and a liquid-phase granular activated carbon polish system. Treatment may also be required for cyanide, chromium, lead and nickel to meet the proposed treatment standards for listed wastes F007, F008 and F009 (F.R., Vol. 54, No. 7.) The LDR treatment standards are listed in Tables 19 and 20 (the standards for non-waste waters would be applicable to the contaminated ground water).

It is anticipated that the treatment units would be designed for an average flow of 13 gpm. Air emissions from the air stripper would be controlled most likely with a carbon canister. The degree of air emissions control required is defined in Section X. Treatment residuals, which may include spent carbon and metals sludge would be disposed of off-site in accordance with U.S. EPA's Off-site Policy and applicable RCRA and DOT regulations.

As with alternative 4A, the treatment and underground injection well system may be combined with Midco II.

Alternatively, the ground water could be treated and then reinjected into the Calumet aquifer if reinjection is conducted in a manner that will prevent spreading of the salt plume. At the end of the pumping, treatment and reinjection operation, the ground water at the site must meet the ground water CALs (Section X). The goal of remedial actions is to restore the ground water quality. Normally, this would require that the remedial action also reduce secondary (non-hazardous) contaminants such as total dissolved solids (TDS) either to background levels or to Secondary Maximum Contaminant Levels (40 CFR 143). However, at Midco I, since there are adjacent contaminant sources, high levels of TDS would be left in the ground water at the site at completion of the remedial action.

Alternative 4E: Ground Water Pumping and Evaporation

A ground water extraction system would be installed and operated in the same manner as in alternatives 4A and 4C. However, the contaminated ground water would be treated by evaporation, instead of by separate treatment operations combined with deep well injection. All contaminants would be concentrated into treatment residuals that would have to be disposed of off-site in accordance with U.S. EPA's off-site policy and applicable RCRA and DOT requirements. The residuals will include blow down and salt cake. In addition, air stripping and carbon adsorption may be required prior to discharge of the condensate. Air emissions will have to be controlled to meet the criteria described in Section X.

The blow down and carbon residuals would likely be incinerated commercially. Cyanide, and metals in the ground water would likely be concentrated in the salt cake. If this occurs, land disposal of the salt cake would likely not be allowed under the Land Disposal Restrictions regulations without prior destruction of the cyanide and treatment of metals (F.R., Vol. 53, No. 7). See Table 20.

The final site cover and handling of contaminated sediments would be the same as in alternatives 4A and 4C.

The evaporation system may be combined with Midco II.

Alternative 5A: Soil Vapor Extraction, Excavation above the Ground Water Elevation and Landfilling

This alternative and alternatives 5C, 5E and 5G treat the source and surface sediments but not the ground water.

Soil Vapor Extraction (SVE):

A soil vapor extraction (SVE) operation would be conducted to treat the volatile organic compounds in the subsurface soil. This would reduce the hazards due to air emissions during excavation and handling of the soils, as well as risks due to leaching into ground water, direct contact and direct ingestion. The required areal extent of treatment and degree of treatment is defined in Section X. Emissions from the SVE would be controlled to the degree defined in Section X.

1. Excavation and Off-Site Disposal:

Following this operation contaminated subsurface materials and surface sediments would be excavated and disposed of off-site. All off-site disposal, including treatment residuals from the SVE, would be required to comply with U.S. EPA's off-site policy and applicable RCRA and DOT regulations. It appears likely that LDR under 40 CFR 268 would disallow this alternative because cyanide, cadmium, chromium, lead, nickel and silver in F007, F008 and F009 wastes would not be treated. The Land Disposal Restrictions for F007, F008 and F009 wastes are scheduled to become effective in June 1989. SVE also may not provide adequate treatment to meet the Land Disposal Restrictions for F001, F002, F003 and F005. These treatment requirements are listed in Tables 19 and 20 (the standards for non-waste waters would be applicable to the contaminated soils).

2. Site Cover and Ground Water:

The site would be restored to grade with uncontaminated fill. Over a long period of time, ground water may attenuate to below CALs. However, in the meantime, the ground water at the site would be highly contaminated and would continue to migrate off-site. It may eventually affect ground water in the area shown in Figure 13. Ground water usage restrictions would be imposed in this area, and nineteen ground water users (including residential drinking water wells) would be connected to the municipal water system. This action would be consistent with RCRA ground water monitoring requirements. It would be inconsistent with RCRA corrective action requirements and Primary Drinking Water Standards because MCLs would be exceeded in off-site ground water. The AWQC may be exceeded in surface waters due to off-site migration of the ground water.

The site would be fenced, deed restrictions imposed and ground water monitoring implemented as in Alternative 2.

Alternative 5C: Soil Vapor Extraction, Excavation Above Water Table, Incineration and Ash Solidification

1. SVE and Air Emissions:

Measures would be taken to ensure that air emissions during excavation and handling of the subsurface material do not exceed the criteria for air emissions defined in Section X. This may require that excavation and handling be conducted during times when weather conditions would minimize the volatile organic emissions, and that special procedures be followed during excavation. Alternatively, a SVE operation may be conducted as described for alternative 5A prior to excavation.

If SVE removes the volatile organic compounds, the risks from direct soil ingestion, in case the site is developed, would be reduced as follows:

	Before	After
Lifetime Carcinogenic*	6.8×10^{-5}	6.0×10^{-5}
Chronic Non-carcinogenic Index*	3.6	3.4

* From Addendum to Public Comment Draft Feasibility Study, March 7, 1989. Table 4-22.

The subchronic hazard index would be reduced for toluene and 2-butanone but would remain above unity for lead, nickel, cyanide, and bis(2-ethylhexyl) phthalate (from Remedial Investigation of Midwest Solvent Recovery (Midco I). December 1987. pp 6-58, 6-59 and Table 6-20). The risks due to air emissions would be nearly eliminated. In addition, the potency of the source for continuing ground water contamination would be reduced substantially, but not eliminated.

2. Incineration:

Following the soil vapor control and excavation operations, the contaminated subsurface soils and surface sediment material would be incinerated. RCRA regulations become applicable to the material excavated and treated. It is anticipated that the incinerator would be a transportable, rotary-cell type, approximately thirty-eight feet long with a ten-foot inner diameter.

The incinerator is expected to have a capacity of approximately 17.5 tons per hour. A secondary combustion chamber would be used to assure complete destruction of the wastes, and a caustic scrubber would neutralize acidic flue gases and control particulate emissions. The incinerator would have to meet the testing and performance standards in 40 CFR 264.341, 264.351, 264.343, 264.342, 7611.70 and special State of Indiana requirements including a test burn and extensive stack sampling.

The incineration should destroy nearly all the organic compounds and cyanide. The metals would largely remain in the ash. The remaining lifetime carcinogenic risk in the ash due to direct soil ingestion would be approximately 2.65 x 10^{-5} due to arsenic.* However, these arsenic represent levels of background concentrations. The remaining cumulative chronic non-carcinogenic risk due to soil ingestion would be less than 1.0 assuming that chromium is in the trivalent form, but would be greater than 1.0 if chromium is in the hexavalent form.* The subchronic risk index would remain above one for lead and nickel. The metals may or may not be in a form that would leach to a significant degree.

The incineration at Midco I may be combined with the incineration at the nearby Ninth Avenue Dump site. For purposes of RCRA and the U.S. EPA off-site policy, the combined action would be considered one site.

The incineration process must satisfy the LDRs for non-waste waters for listed wastes No. F001, F002, F003, F005, F007, F008, F009 (see Tables 19 and 20). However, a capacity variance is in effect for soil, waste and debris until November 1990 for waste categories F001, F002, F003 and F005.

Solidification:

Following incineration, the concentrations of some inorganic compounds in the ash will be similar to concentrations in some listed hazardous wastes for which treatment is required prior to land disposal. This is shown in Table 9 in the Appendix. Therefore, solidification/stabilization (S/S) of the ash will be required following the incineration, unless TCLP tests show that hazardous constituents in leachate from the unsolidified ash are at concentrations less than the LDR treatment standards required under the 40 CFR 268 for F007, F008 and F009 (see Table 10). Following solidification/stabilization, the solidified mass must meet the LDR treatment requirements for F001, F002, F003, F005, F007, F008 and F009, or must meet standards for a Treatability Variance if this is approved pursuant to 40 CFR 268.44.

In addition, if the ash is a hazardous waste by characteristic, D004, D005, D006, D007, D008, D009 and D010, land disposal restrictions for these wastes may be applicable at the time of the action.

Site Cover and Ground Water:

The incinerated/solidified material would be placed on-site. The design of the final cover would depend on the results of the leachate tests on the ash or solidified material. If the waste is delistable, a two-foot soil cover would be placed over the site. If not, a final cover in compliance with applicable RCRA landfill closure requirements would be installed. It is anticipated that if S/S is not required, the final cover will provide adequate protection against the direct contact risk.

As in Alternative 5A, ground water monitoring, usage restrictions and municipal water connections would be implemented. This alternative would be inconsistent with RCRA corrective action requirements and Primary Drinking Water Regulations.

Alternative 5E: Vapor Extraction and Solidification

Two methods of mixing for solidification are available. One involves excavation, mixing above ground and replacement of the solidified material on-site; the second involves in-situ addition of reagents and mixing.

1. Above Ground Mixing:

If above ground mixing is used, then a soil vapor extraction operation as described for alternative 5A must be completed prior to excavation.

Following the soil vapor extraction, the residual risks may be as described for Alternative 5C.

Following this operation, subsurface materials above the ground water table and surface sediments that exceed soil CALs would be excavated, mixed with water, binder and reagents in a tank and then placed back on site to cure. It is anticipated that the contaminated materials would be fed to the mixer at a maximum rate of 75 cubic yards per hour. Large items such as stumps would be sifted out and sandwiched inside layers of solidified material on the site.

Once the contaminated subsurface materials and sediments are excavated and treated, the RCRA regulations become applicable. Pursuant to 40 CFR 268, land disposal of the solidified material would not be allowed unless the LDR treatment standards are attained (see Tables 19 and 20), or Treatability Variance Treatment standards are attained (See Table 21) (40 CFR 268.44). Until November 1990, there are no LDR treatment standards in effect for waste categories F001, F002, F003 and F005 in soil, waste and debris because of a capacity variance.

The proposed LDR treatment standards for cyanide require destruction of cyanide rather than reduction in mobility. Because it may be impossible to meet the LDR treatment standard for cyanide by S/S, and because existing available data do not demonstrate that full-scale operation of S/S can attain the LDR treatment standards consistently for all soil and debris at this site, this alternative will comply with the LDRs through a Treatability Variance. The required treatment standards (based on results of Toxicity Characteristic Leaching Procedure (TCLP) tests) are summarized in Table 21. Constituents that are not listed in Table 21 should be reduced in mobility by 90% based on TCLP tests.

Land Disposal Restrictions applicable to hazardous wastes by characteristic (D003, D004, D005, D006, D007, D008, D009, D010) may also become applicable to the operation by the time S/S is implemented.

2. In-situ Mixing:

As an alternative to excavation and solidification, the subsurface soil would be solidified in-situ. It is anticipated that the system would utilize a crane-mounted mixing system. The mixing head would be enclosed in a bottom-opened cylinder to allow closed system mixing of the treatment chemicals with the soil. The bottom-opened cylinder would be lowered onto the soil and the mixing blades would be started, moving through the depth in an up and down motion, while chemicals are introduced. Vapors and dust would be pulled into the vapor treatment system, composed of a dust collection system followed by in-line activated carbon treatment. An induced draft fan would exhaust the treated air to the atmosphere. At the completion of a mixing, the blades would be withdrawn and the cylinder removed. The cylinder would then be placed adjacent to and overlapping the previous cylinder. This would be repeated until the entire area has been treated.
The surface sediments would be scraped up and consolidated on-site for solidification.

Prior to in-situ solidification, a soil vapor extraction operation may have to be conducted to reduce volatile organic compounds enough so that emissions during mixing and curing (after the vapor treatment system is removed) meet the criteria for air emissions and so that leachate from the solidified mass will not cause exceedance of the ground water CALs for volatile organic compounds (Section X).

Using in-situ mixing, the LDRs would not be applicable nor considered to be relevant and appropriate. The S/S will be considered successful if it reduces the mobility of contaminants so that leachate from the solid mass will not cause exceedance of Cleanup Action Levels in the ground water (see Section X).

3. Residual Risks:

If the vapor extraction/solidification operation is successful, the exposures due to air emissions, direct soil ingestion and leaching to ground water should be nearly eliminated.

The SVE, by itself, should remove and treat most of the volatile organic compounds. The residual risks following SVE are described for alternative 5C. Using solidification, the mobility of hazardous constituents would be reduced through binding or entrapment of hazardous constituents in a solid mass with low permeability that resists leaching. S/S has been selected as the best demonstrated available technology (BDAT) or part of a BDAT for treatment of a number of RCRA hazardous wastes for the Land Disposal Restrictions (40 CFR 268). These include the following listed hazardous wastes: F006, K001, K015, K022, K048, K049, K050, K051, K052, K061, K086, K087, K101. These listed hazardous wastes contain the following hazardous constituents: cadmium, chromium, lead, nickel, silver, arsenic, and selenium (40 CFR 268, promulgated August 17, 1988). S/S is considered a potentially applicable technology for treatment of hazardous wastes by characteristic numbers D004, D005, D006, D007, D008, and D010, which contain arsenic, barium, cadmium, chromium, lead, and selenium (F.R., Vol. 54, No. 7, p. 1098-1099).

The S/S process has weaknesses. Some constituents interfere with the bonding with waste materials. This includes high organic content (>45% by weight), semivolatile organic compounds greater than 1.0%, cyanide greater than 3,000 ppm, and high oil and grease (>10%). SVE should reduce those volatile and semi-volatile organic compounds. In addition, halide may retard setting, and soluble manganese, tin, zinc, copper and lead salts increase the leachability potential (Technology Screening Guide for Treatment of CERCLA Soils and Sludges, EPA/540/2-88/004. Sept. 1988). Midco I subsurface materials contain halide; elevated zinc, manganese, copper and lead; semivolatile compounds up to 0.8%, and cyanide up to 2720 ppm.

In addition, the long term integrity of the solidified material is not well documented because few projects have been in place for long periods of time. This is of concern because organic constituents are usually not considered to be treated by this process but only encapsulated. There is very little data available on the applicability of S/S to cyanide wastes. In one study, the mobility of arsenic was increased by orders of magnitude by the S/S. Chromium and arsenic are difficult to solidify and may require specialized binders. Organic lead may not be effectively treated by S/S (F.R., Vol. 54, No. 7, pp. 1098, 1099).

Therefore, U.S. EPA cannot be sure how successful S/S will be at Midco I until treatability tests are completed. These tests are being initiated. In addition, treatability tests are needed to determine the proper formulation for the solidification reagents.

4. Final Site Cover:

If the subsurface materials are excavated, RCRA hazardous waste regulations become applicable, and the final site cover must meet RCRA landfill closure requirements, unless the waste is delisted pursuant to 40 CFR 260.22. However, RCRA does not presently utilize leach tests in delisting procedures for organic compounds. The final site cover must also protect the solidified material from degradation due to environmental factors such as acid rain and the freeze-thaw cycle.

If in-situ mixing is used, RCRA landfill closure requirements are not applicable. However, these requirements may be considered relevant and appropriate by U.S. EPA depending on the results of the treatability study. At a minimum, the cover must protect the solidified material from environmental degradation, minimize maintenance, promote drainage, and minimize erosion.

5. Ground Water and Access:

Ground water usage restrictions, well connections, deed restrictions, access restrictions and monitoring would be implemented as in alternative 5A. This alternative would be inconsistent with RCRA corrective action requirements and Primary Drinking Water Regulations.

Alternative 5G: In-Situ Vitrification

In this thermal treatment process, a square array of four electrodes are inserted into the ground to the desired treatment depth of 4.5 feet. A conductive mixture of flaked graphite and glass frit is placed among the electrodes as a path for the current. Voltage is applied to the electrodes to establish a current in the starter path. The resultant power heats the starter path and surrounding soil up to 3600°F. The soil becomes molten at temperatures between 2000° and 2500°F. As the vitrified zone grows it incorporates non-volatile elements and destroys organic compounds by pyrolysis. Pyrolyzed products move to the surface where they combust. A hood over the process collects off-gases for treatment. The hood remains over the melt until gassing stops, in approximately four days. Thus, two hoods are required for sequential batch processing. The vitrified mass is left in place and any subsidence in backfilled with clean fill and seeded. In addition, contaminated sediments would be scraped and transported to the site for vitrification.

The advantages of in-situ vitrification include that excavation isn't required (except for surface sediments, which would be scraped up and consolidated on-site for vitrification), air emissions are controlled in place, organic compounds are destroyed and inorganic compounds are incorporated into a glassy solid matrix resistant to leaching and more durable than granite or marble (Technology Screening Guide for Treatment of CERCLA Soils and Sludges, EPA/540/2-88/004, Sept. 1988).

Disadvantages of in-situ vitrification include that, although it has been tested in pilot studies, it has not been demonstrated in a full scale commercial application. In addition, the commercial availability of the equipment is limited. The presence of ground water only five feet below the surface severely limits the economic practicability because of the energy expended in driving off water. The presence of buried metals and combustible solids below the surface may also cause problems in the operation (Technology Screening Guide for Treatment of CERCLA Soils and Sludges, EPA/540/2-88/004, Sept. 1988).

Because the organic compounds are destroyed and inorganic compounds incorporated into a solid mass resistant to leaching, it is expected that the treated material will be delistable. If tests show that the residue is delistable, only a soil cover would be placed over the site.

Ground water usage restrictions, well connections, deed restrictions, access restrictions and monitoring would be implemented as in alternative 5A. This alternative would be inconsistent with RCRA corrective action requirements and Primary Drinking Water Regulations.

Alternative 6: Containment with Soil Vapor Extraction and Solidification

This alternative combines the source treatment measures in alternative 5E with the containment measures in alternative 3. The advantage of this alternative over alternative 3 alone is that the risks from residual subsurface soil contamination within the containment barrier would be nearly eliminated. The contaminants in the ground water would remain but they would be contained within the slurry wall.

Should the slurry wall fail, the ground water in the area shown in Figure 13 may eventually be affected. Although the contamination may eventually attenuate, the risks from ingestion of ground water on the site itself would remain very high for a long time.

The soil vapor extraction operation would remove the primary source of ground water contamination although the remaining semi-volatile compounds and metals could be a continuing source of ground water contamination. Assuming that the soil vapor extraction removes all volatile organic compounds, the risks from direct soil ingestion in case the site is developed would be reduced as follows:

	Before	After
Lifetime Carcinogenic*	6.8×10^{-5}	6.0×10^{-5}
Chronic Non-carcinogenic Index*	3.6	3.4

* From Addendum to Public Comment Draft Feasibility Study, March 7, 1989, Table 4-22.

The subchronic hazard index would be reduced for toluene and 2-butanone but would remain above unity for lead, nickel, cyanide, and bis(2-ethylhexyl) phthalate (From Remedial Investigation of Midwest Solvent Recovery (Midco I) December 1987. pp 6-58, 6-59, Table 6-20).

Risks from air emissions from the source, in case the cap is disturbed, would be eliminated.

If successful, the S/S process would nearly eliminate the remaining risks due to the source.

Alternative 7: Ground Water Pumping and Deep Well Injection with Soil Vapor Extraction and Solidification

This alternative combines the source treatment measures in alternative 5E with the ground water treatment measures in alternative 4A.

At the conclusion of this action, the site would be close to meeting RCRA clean closure requirements. However, long-term monitoring and maintenance would be required because the long-term effectiveness of S/S is not well documented.

Alternative 8: Ground Water Pumping, Treatment and Deep Well Injection with Soil Vapor Extraction and Solidification

This alternative combines the source treatment measures in alternative 5E with the ground water treatment measures in alternative 4C.

At the conclusion of this action, the site would be close to meeting RCRA clean closure requirements. However, long-term monitoring would be required because the long term effectiveness of S/S is not well documented.

Alternative 9: Ground Water Pumping and Evaporation with Soil Vapor Extraction and Solidification

This alternative combines the source treatment measures in alternative 5E with the ground water treatment measures in alternative 4E.

At the conclusion of this action, the site would be close to meeting RCRA clean closure requirements. However, long-term monitoring would be required because the long-term effectiveness of S/S is not well documented.

IX. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

In selecting the final remedial actions for Superfund sites, U.S. EPA considers the following nine criteria:

1. Overall Protection of Human Health and the Environment: addresses whether or not a remedy provides adequate protection, and describes how risks are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

2. Compliance with ARARs: addresses whether or not a remedy will meet all of the applicable or relevant and appropriate (ARARs) requirements of other environmental statutes and/or provide grounds for invoking a waiver.

3. Long-term effectiveness and permanence: refers to the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

4. Reduction of toxicity, mobility, or volume (TMV): is the anticipated performance of the treatment technologies a remedy may employ.

5. Short-term effectiveness: involves the period of time needed to achieve protection from any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

6. Implementability: is the technical and administrative feasibility of a remedy, including the availability of goods and services needed to implement the chosen solution.

7. Cost: includes capital and operation and maintenance costs.

8. Support Agency Acceptance: indicates whether, based on its review of the RI/FS and Proposed Plan, the state agency (the Indiana Department of Environmental Management) concurs, opposes, or has no comment on the preferred alternative.

9. Community Acceptance: will be assessed from the public comments received.

These nine criteria incorporate factors required to be addressed in the remedy selection process in SARA Section 121.

A comparison of the fourteen alternatives using the nine criteria is included in Tables 10, 11 and 12. A comparison of costs among the fourteen alternatives is in Table 13. Table 14 compares some major factors considered in the effectiveness evaluation among the fourteen alternatives. These Tables are included in the Appendix.

The no-action alternative (1) is unacceptable because ARARs for groundwater and surface waters would be exceeded and human health and environmental risks from continued air emissions and groundwater migration will be unacceptable.

Alternatives that address only the source (alternatives 2, 5A, 5C, and 5G) are unacceptable because although groundwater and surface water contamination may eventually attenuate, this will take many years (estimate 60-117 years). In the meantime, ARARs for the groundwater and surface water would be exceeded, the groundwater plume would eventually affect a large area, and biota may be adversely affected by groundwater recharge to surface waters and air emissions. In addition, protection from future groundwater usage, would require usage restrictions in a fairly large area. This would be difficult to implement.

The containment alternatives 3 and 6 would provide protection to human health and the environment for as long as the site cap and slurry wall are maintained. However, the high salt and organic concentrations may affect the permeability of the slurry wall, resulting in the need to replace it in the long term. If future development occurs or the cap or slurry wall are damaged, the resulting health risks may be similar to no action for alternative 3, and to alternatives addressing only the source for alternative 6. Costs for remedying such a failure would be similar to but higher than the original installation. In that case, the total cost for a containment alternative would be similar to the cost for remedial actions that treat both the source and the ground water.

Alternatives that include only treatment of the ground water (4A, 4C, 4E) would attain a considerable degree of permanent protection. Contaminants presently in the ground water and contaminants that are flushed into the ground water would be reduced in toxicity, mobility, and volume (TMV) by operation of the ground water treatment system over a long period of time.

The site cover and access restrictions would protect against on-site direct ingestion and direct contact risks.

At the completion of the ground water action, residual contamination will remain under the site cover, although it will be reduced from the present conditions. It is uncertain what residual risks will remain. It is possible that mobile contaminants will remain under the cover after completion of the ground water treatment actions. If the cover is subsequently disturbed or degraded, these residuals will again cause ground water contamination. Even if relatively mobile components, such as volatile organic compounds, phenol and cyanide are flushed from the soil, the residual risks due to direct ingestion in case of future development would be: 6.0×10^{-5} lifetime carcinogenic risk, with a chronic non-carcinogenic index = 1.1 if chromium is trivalent, and 3.1 if chromium is hexavalent. Subchronic risks from lead, nickel, and bis (2-ethylhexyl) phathate would likely remain. In addition, lead and chromium are present in some of the subsurface material at concentrations similar to those in some listed hazardous wastes, for which treatment is required prior to land disposal pursuant to 40 CFR 268 (see Table 9).

For these reasons, an alternative that combines a source treatment measure with a ground water treatment measure is needed. Of the source treatment measures, soil vapor extraction (SVE) by itself would reduce a large portion of the risks from future releases to ground water, air emissions, and reduce the direct ingestion risk to a significant degree. This is explained in the discussion for alternative 6. However, following SVE, residual risks will remain, and lead and chromium will be present in some subsurface materials at concentrations similar to those in some listed hazardous wastes, for which treatment is required prior to land disposal pursuant to 40 CFR 268 (see Table 9). SVE combined with S/S would address all risks due to the source if they are successful. The effectiveness of S/S at Midco I would be evaluated by treatability tests prior to its implementation.

Compared to SVE and S/S, incineration would more reliably and permanently treat the organic compounds, it also may make subsequent solidification easier. However, incineration is considerably more expensive than SVE and S/S, and, if S/S is successful, incineration would do little to further reduce risks.

Vitrification, if it worked, would more reliably address both the organic and inorganic contaminants. It also treats both organic and inorganic compounds in one operation, which is an advantage. However, there is a large degree of uncertainty about whether vitrification is practical at this site because of the high water table. In addition, it is estimated to be considerably more expensive than SVE combined with S/S and, if S/S is successful, would do little to further reduce risks.

All the ground water treatment alternatives would result in attaining ARARs and providing long-term protection of the Calumet aquifer at the site when combined with a source treatment alternative. They differ only in their method of treatment and disposal of the highly saline contaminated ground water. The treatment and deep well injection or reinjection into the Calumet aquifer alternative (4C) may substantially reduce TMV of contaminants in the ground water prior to deep well injection.

Organic compounds would be removed by stripping and carbon absorption. If residuals from this treatment are incinerated, this would provide permanent treatment of these contaminants. If they are landfilled, the disposal may not be considered any more permanent than deep well injection without treatment. If cyanide treatment is required, a chlorination process may be used, which should permanently destroy the cyanide. Metals may be removed by precipitation. The metals sludge would be landfilled but may require solidification first. This disposal may not be considered more permanent than deep well injection without treatment.

Reinjection into the Calumet aquifer would be acceptable to U.S. EPA if it meets CALs and is conducted in a manner that will not spread the salt plume. However, deep well injection is preferable because it would remove the salt contamination from a usable aquifer.

The evaporation alternative (4E) would reduce the volume of all contaminants and the toxicity of contaminants in the blow down by incineration. However, extensive treatment of the salt cake would likely be required prior to land disposal under the RCRA Land Disposal Restrictions. If such treatment is not required, alternative 4E would include disposal of significant quantities of hazardous wastes in off-site landfills.

The deep well injection without treatment alternative (4A) would not reduce TMV of contaminants in the ground water. However, if a petition to allow land disposal is approved by U.S. EPA, this alternative should provide permanent human health and environmental protection since the petition must demonstrate that there will be no migration from the injection zone while the wastes remain hazardous. In addition, alternative 4A is considerably less expensive than alternative 4C.

X. THE SELECTED REMEDY

U.S. EPA selects either alternative 7 or 8 for implementation at Midco I. These alternatives are described in Sections XIII and IX. Alternative 7 will be implemented if a petition to allow injection of waste prohibited under 40 CFR Part 148 Subpart B is approved by U.S. EPA. In this case, the permanence of the remedial action would be considered equivalent to alternative 8, and alternative 7 is less expensive. If a petition is not approved, alternative 8 must be implemented. Alternative 8 may include deep well injection of the salt contaminated ground water or reinjection of the ground water into the Calumet aquifer.

The selected alternative will also include site access restrictions and deed restrictions, as appropriate. Either alternative will include treatment of the source by a combination of SVE and S/S. This is the least expensive alternative that will permanently reduce TMV of the source, and be fully protective of human health and the environment. However, implementation of this source remedial action depends on the results of the treatability tests for S/S. If the treatability tests show that S/S will not provide a significant reduction in mobility of the hazardous substances of concern, the ROD will be reopened and a different source control measure will be selected. A more detailed cost breakdown for these alternatives is in Tables 15 and 16 in the Appendix.

Clean Up Action Levels (CALs):

Soil Clean Up Action Levels:

All subsurface materials affected by the site or by Midco operations that exceed any of the following risk-based levels will be treated:

Cumulative Lifetime Carcinogenic Risk = 1×10^{-6}
Cumulative Chronic Noncarcinogenic Index = 1.0
Subchronic Risk Index = 1.0

In addition, contaminated surface sediments within the area shown in Figure 14 that exceed the above levels will be excavated and treated.

Ground Water Clean Up Action Levels:

All portions of the Calumet aquifer affected by the site or by Midco operations that exceed any of following risk-based levels will be recovered and treated (except as provided for in the subsequent discussion). The ground water pumping, treatment and disposal system shall continue to operate until the hazardous substances in all portions of the Calumet aquifer affected by the site or by Midco operations are reduced below each of these risk-based levels (except as provided for in the subsequent discussion). Applying the CALs throughout the contaminated plume is consistent with F.R., Vol. 53, No 245, p. 51426.

Cumulative Lifetime Carcinogenic Risk = 1×10^{-5}
Cumulative Noncarcinogenic Index = 1.0
Subchronic Risk = 1.0
Primary MCLs (40 CFR 141)
Chronic AWQC for protection of aquatic life multiplied by a factor of 3.9 (to account for dilution)

Evaluation of Attainment of CALs:

The risk levels will be calculated from the soil and ground water analytical results using the assumptions listed in Tables 2, 3, 4 and 5 in the Appendix (except that in place of the average site concentration, actual measured soil and ground water concentrations in each sample location will be used, and soil ingestion rates for chronic exposures of 0.2 gram per day for ages 1-6 and 0.1 gram per day for older age groups will be used), the procedures in the Superfund Public Health Evaluation Manual and U.S. EPA's most recently published carcinogenic potency factors and reference doses.

For inorganic compounds in ground water, the analytical results from filtered samples will be used. The analytical procedures will at least reach the analytical detection limits listed in Tables 17 and 18 in the Appendix. Constituents that are not detected shall not be included in risk calculations. Constituents that are detected below background concentrations identified in Tables 17 and 18 shall not be included in the risk calculations.

If only one constituent is detected in ground water at a concentration that is calculated to potentially cause a lifetime, incremental carcinogenic risk of 1×10^{-5} or greater, and an MCL has been promulgated for this constituent pursuant to 40 CFR 141, then the MCL will be the CAL for that constituent. In addition, that constituent will not be used in the cumulative risk calculation.

JUSTIFICATION FOR USE OF 10^{-5} RISK LEVEL:

Use of the 1×10^{-5} lifetime, cumulative carcinogenic risk level is recommended for the ground water CAL as opposed to the 1×10^{-6} level because there are multiple contaminant sources that are affecting the Calumet aquifer in the vicinity of the Site. In addition, the 10^{-6} level is generally well below the analytical detection limits for the constituents of concern.

CRITERIA FOR CONTROL OF AIR EMISSIONS:

Each separate source of air emissions shall be controlled to prevent exposures to the nearest resident and workers on adjacent properties from causing an estimated cumulative, incremental, lifetime carcinogenic risk exceeding 1×10^{-7}. Since there are multiple operations that cause air emissions, each must be controlled to the 1×10^{-7} carcinogenic risk level to assure that the total risk will be less than 1 x 10^{-6}. The following operations will be considered separate sources:

1. Subsurface soil excavation and handling;
2. Emission from SVE;
3. Emissions from S/S;
4. Emissions from ground water treatment.

The risk levels will be calculated using conservative assumptions, the procedures in the U.S. EPA Public Health Evaluation Manual and Exposure Assessment Manual, and the most recent U.S. EPA published carcinogenic potency factor. The emissions must also be controlled to prevent any non-carcinogenic risk either on-site or off-site. Fugitive dust must be controlled in compliance with State of Indiana requirements.

CRITERIA FOR DISCONTINUATION OF SOIL VAPOR EXTRACTION SYSTEM:

The soil vapor extraction system shall be operated until the following criteria is met:

1. Until the solidification operation will meet the criteria for air emission defined above;

2. If soils are excavated and solidified, until applicable treatment standards for VOCs in 40 CFR 268 will be met following solidification;

3. If soils are solidified in-situ; until ground water CALs will not be exceeded due to leaching of VOC's from the solidified mass.

The selected remedial actions will be protective of human health and the environment, will attain applicable or relevant and appropriate Federal and State requirements and are cost effective. The remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility or volume as a principal element and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

The State of Indiana is expected to concur with the selected remedial actions. Although there is some public concern about the deep well injection operation, it is believed that the protective measures required in U.S. EPA's Underground Injection Control Program coupled with source (soil) treatment provide a more acceptable technology for the community than the further degradation of the existing Calumet aquifer or the Grand Calumet River.

Because the remedy will result in hazardous substances remaining on-site above health-based levels, a review will be conducted within five years after commencement of remedial actions to ensure that the remedy continues to provide adequate protection of human health and the environment.

APPENDIX TO MIDCO I RECORD OF DECISION

Table 1: Concentrations in Various Environmental Media

Table 2: Standard Parameters Used for Dosage

Table 3: Potential Exposure Pathways for the Midco I Site

Table 4: Routes of Exposures Used in Calculation of Intakes

Table 5: Characteristics of Subchronic/Chronic Exposure Scenarios

Table 6: Midco I Location Specific Requirements

Table 7: Midco I Action Specific Requirements

Table 8: Alternative's Compliance with Applicable Laws and Regulations

Table 9: Comparison of Concentrations of Inorganics in Subsurface Material at Midco I with Concentrations in Listed Hazardous Wastes

Table 10: Effectiveness Evaluation of Alternatives

Table 11: Implementability Evaluation of Alternatives

Table 12: Detailed Analysis Summary

Table 13: Midco I Estimated Costs in Millions of Dollars and Time to Implement

Table 14: Midco I Table of Effectiveness and Implementability

Table 15: Alternative 7 ... Cost Estimate

Table 16: Alternative 8 ... Cost Estimate

Table 17: Ground Water Cleanup Action Levels

Table 18: Soil Cleanup Action Levels

Table 19: Land Disposal Restriction Treatment Standards for Waste Categories F001, F002, F003, F005 (from 40 CFR 268.41)

Table 20: Proposed Land Disposal Restriction Treatment Standards for Waste Categories F007, F008, F009 (from F.R., Vol. 53, No. 7, p. 1068)

Table 21: Alternative Treatability Variance Levels and Technologies for Structural/Functional Groups

Responsiveness Summary

A Guide to the Underground Injection Control Program in Indiana

Waste Treatment Results for Inorganics

Table 1

UPDATED 14 OCTOBER 1987

WORKSHEET 1
SCORING FOR INDICATOR CHEMICAL SELECTION
CONCENTRATIONS IN VARIOUS ENVIRONMENTAL MEDIA

NAME OF SITE: MEDCO 1
DATE PREPARED 3 MARCH 1987
ANALYST Sharon Long
VERIFIED BY T.A. SCHALLER

CHEMICAL	PHASE 1 GROUND WATER (mg/L)			PHASE 2 GROUND WATER (mg/L)			PHASE 1 UPGRADIENT GROUND WATER (mg/L)			PHASE 2 UPGRADIENT GROUND WATER (mg/L)		
	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN
Aluminum U	1.70E-01	4.13E+01	8.71E+00	2.70E-02	7.00E+01	1.27E+01	ND	2.40E+00	1.21E+00	2.70E-02	4.80E-01	1.00E-01
Antimony	ND	2.29E-02	3.68E-03									
Arsenic	ND	6.00E-02	1.16E-02	ND	1.02E+00	2.11E-02	ND	1.10E-02	2.09E-03	ND	8.70E-03	1.49E-03
Barium	ND	1.14E+01	8.89E-01	1.00E-02	9.20E+00	6.84E-01	ND	1.1[illegible]	2.69E-01	3.16E-02	1.20E-01	6.20E-02
Beryllium												
Cadmium	ND	2.29E-02	4.28E-03	ND	2.00E-02	2.45E-03						
Calcium U	3.05E+00	1.27E+03	2.06E+02	8.70E+00	9.11E+02	1.95E+02	1.40E+01	2.89E+02	1.40E+02	7.60E+01	1.60E+02	1.30E+02
Chromium	ND	2.27E+00	1.02E-01	ND	9.60E+00	2.09E-01	ND	2.14E-01	3.62E-02	ND	6.00E-03	3.07E-03
Cobalt U	ND	6.00E-02	6.84E-03	ND	9.10E-02	1.73E-02						
Copper	ND	1.20E+00	1.09E-01	ND	2.02E-01	1.09E-02	ND	2.00E-02	3.30E-03	1.20E-02	3.20E-02	1.84E-02
Iron U	1.13E+00	1.07E+03	2.91E+01	6.44E-02	2.73E+01	9.29E+00	1.27E+00	1.53E+01	7.16E+00	1.84E-01	4.60E+00	1.42E+00
Lead	ND	8.89E-01	4.15E-02	ND	1.70E-01	6.29E-03	ND	2.30E-02	1.11E-03			
Magnesium U	3.00E+00	3.53E+02	7.01E+01	1.82E-01	3.44E+02	5.97E+01	6.53E+00	7.36E+01	5.17E+01	7.00E+01	9.00E+01	3.89E+01
Manganese U	9.09E-02	6.01E+00	1.29E+00	4.90E-03	2.40E+00	6.29E-01	9.09E-03	2.47E+00	6.16E-01	2.40E-02	1.77E+00	5.04E-01
Mercury	ND	1.20E-03	2.16E-04	ND	1.80E-03	3.08E-05	ND	3.90E-03	7.30E-04			
Nickel	ND	2.16E+01	1.22E+00	ND	3.41E+01	1.07E+00	ND	1.00E-01	2.02E-02	ND	7.10E-02	2.07E-02
Potassium U	2.28E+00	4.86E+02	1.06E+02	3.20E+00	5.16E+02	4.78E+01	1.06E+01	6.76E+01	2.91E+01	2.40E+00	7.34E+01	2.13E+01
Selenium	ND	4.00E-02	3.04E-03	ND	1.29E-02	4.04E-04						
Silver	ND	4.16E-02	4.31E-03	ND	1.00E-02	1.03E-03	ND	1.00E-02	3.30E-03			
Sodium U	1.02E+01	2.70E+04	4.23E+03	1.40E+01	2.34E+04	2.03E+03	5.20E+01	6.75E+02	1.01E+02	2.16E+01	4.32E+02	1.75E+02
Thallium U	ND	6.00E-02	4.42E-03									
Tin	ND	1.21E+00	1.07E-01									
Vanadium	ND	1.60E-01	2.89E-02	ND	1.30E-01	2.44E-02				ND	4.40E-03	2.09E-03
Zinc	3.09E-02	3.11E+00	4.70E-01	ND	4.40E+00	1.63E-03	6.60E-02	2.16E-01	1.37E-01	3.00E-02	6.80E-02	5.16E-02
Acenaphthene U												
Acenaphthylene U												
Acetone U*	ND	1.10E+01	3.13E+00	ND	2.00E+01	1.70E+00						
Anthracene U				ND	4.00E-03	1.40E-04						
Benzene	ND	5.00E+00	2.54E-01	ND	6.00E+00	2.89E-01						
Benzo(a)anthracene												
Benzo(a)pyrene												
Benzo(b)fluoranthene U												
Benzo(g,h,i)perylene U												
Benzoic acid U	ND	1.29E-02	3.89E-03	ND	1.30E-02	6.59E-04						
Benzyl alcohol U	ND	1.00E-01	8.24E-03	ND	2.00E-02	9.62E-04						
Bis(2-chloroethyl)ether	ND	2.00E-02	1.15E-03	ND	2.30E-02	1.16E-03						
Bis(2-ethylhexyl)phthalate	ND	2.90E-02	3.60E-03	ND	1.60E-02	1.34E-03	ND	2.50E-02	5.60E-03			
2-Butanone (MEK)	ND	8.40E+01	1.26E+01	ND	6.00E+01	7.01E+00						
Carbon disulfide	ND	9.10E-03	3.50E-04									
Chlorobenzene												
Chlordane												
Chloroethane U	ND	2.00E+00	8.07E-02	ND	1.29E+00	7.15E-02						
Chloroform	ND	2.70E+00	1.04E-01	ND	1.30E+00	5.00E-02						
Chrysene U												
Cresol	ND	8.00E-01	4.70E-02	ND	8.00E-01	6.61E-02						
4,4'-DDD												
Dibenzo(a,h)anthracene U												
Dibenzofuran U												
1,4-Dichlorobenzene												
1,1-Dichloroethane	ND	4.37E-01	3.87E-02	ND	8.00E-01	5.46E-02						
1,2-Dichloroethane	ND	1.10E-01	3.88E-03	ND	2.10E-02	8.08E-04						
1,1-Dichloroethene	ND	1.00E-01	3.85E-03	ND	4.30E-03	1.68E-04						
Trans-1,2-dichloroethene	ND	9.87E+00	2.80E-01	ND	7.70E+00	3.46E-01						
2,4-Dichlorophenol	ND	4.00E-03	1.85E-04	ND	3.80E-03	1.41E-04						
2,4-Dimethylphenol U	ND	1.00E-01	6.77E-03	ND	1.20E-01	5.16E-03						
Endrin U				ND	8.00E-04	1.80E-05						
Ethylbenzene	ND	1.50E+00	1.07E-01	ND	1.80E+00	1.04E-01						
Fluoranthene U	ND	2.00E-03	1.15E-04									
Fluorene U												
Indeno(1,2,3-cd)pyrene U												
Isophorone U	ND	8.00E-01	6.01E-02	ND	1.30E+00	7.40E-02						
2-Methylnaphthalene U												
Methylene chloride	ND	3.20E+02	3.24E+01	ND	3.80E+02	1.29E+01						
Naphthalene U	ND	2.10E-02	1.40E-03	ND	2.20E-02	1.77E-03						
Nitrobenzene U*	ND	2.00E-03	1.80E-04									
N-Nitrosodiphenylamine U	ND	2.80E-03	1.80E-04	ND	3.00E-03	1.11E-04	ND	2.20E-03	3.07E-04	ND	3.00E-03	3.00E-04
PCBs												
Pentachlorophenol U*	ND	7.20E-02	3.04E-03									
Phenanthrene U	ND	8.20E-03	2.60E-04	ND	4.00E-03	1.40E-04						
Phenol	ND	1.70E+01	6.11E-01	ND	3.70E+01	2.60E+00						
Pyrene U												
Styrene U*												
1,1,2,2-Tetrachloroethane												
Tetrachloroethene				ND	3.70E-01	1.51E-02						
Toluene	ND	3.50E+01	2.27E+00	ND	4.00E+01	2.00E+00						
1,1,1-Trichloroethane	ND	7.00E+00	3.16E-01	ND	6.30E+00	3.54E-01						
Trichloroethene	ND	8.10E-01	4.80E-02	ND	3.00E-01	1.04E-02						
Vinyl chloride	ND	3.00E+00	1.23E-01	ND	1.80E+00	5.77E-02						
Xylene	ND	1.10E+01	9.42E-01	ND	7.00E+00	6.23E-01						
2-Hexanone U	ND	2.34E-01	2.24E-02	ND	1.10E-01	4.23E-03						
4-Methyl-2-pentanone U*	ND	3.40E+01	2.22E+00	ND	3.10E+01	2.00E+00						
Diethyl phthalate U	ND	2.70E-02	6.46E-03				ND	5.00E-03	3.20E-04			
Butyl benzyl phthalate U	ND	3.20E-03	1.23E-04									
Di-n-octyl phthalate	ND	3.00E-03	1.15E-04									
Cyanide U*	ND	1.40E+01	1.52E+00	ND	3.67E+00	2.80E-01				ND	1.20E-02	3.34E-03
4-Chloro-3-methylphenol												
N-nitrosodipropylamine												
Di-n-butylphthalate												
Dieldrin				ND	3.20E-04	1.16E-05						
Aldrin												
Gamma-BHC(Lindane)				ND	2.20E-04	9.24E-06						
AROCLOR 1242 & 1254												
AROCLOR 1248												
4,4'-DDT												

U = UNKNOWN: NO TOXICITY CONSTANTS FOR THE ENVIRONMENTAL MEDIA AVAILABLE
U* = REFERENCE DOSE AVAILABLE, THEREFORE, CONSIDERED IN THE FINAL IS VALUES

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WORKSHEET 1 CONTINUED

NAME OF SITE: MCCD 1
DATE PREPARED: 3 MARCH 1987
ANALYST: SHARON LONG
VERIFIED BY: T. A. SCHULLER

UPDATED: 14 OCTOBER 1987
BY: TAS

CHEMICAL	PHASE 1 SURFACE WATER (mg/L) MIN	MAX	MEAN	PHASE 2 SURFACE WATER (mg/L) MIN	MAX	MEAN	SOILS (mg/kg) MIN	MAX	MEAN	UPGRADIENT SOILS (mg/kg) MIN	MAX	MEAN
Aluminum U	2.20E-01	6.10E+00	1.15E+00	8.00E-02	6.10E+00	1.15E+00	4.50E+03	2.14E+04	3.94E+03	6.42E+02	1.17E+03	9.00E+02
Antimony							ND	6.40E+00	6.67E-01	ND	1.00E+00	8.00E-01
Arsenic	ND	3.10E-02	5.54E-03	ND	8.00E-03	2.25E-03	ND	3.40E+01	3.90E+00		BACKGROUND	
Barium	ND	3.00E-01	7.00E-02	2.47E-03	2.37E-01	9.00E-02		BACKGROUND			BACKGROUND	
Beryllium								BACKGROUND			BACKGROUND	
Cadmium				[illegible]	1.10E-02	3.00E-03	ND	1.70E-01	1.20E+00		BACKGROUND	
Calcium U	1.20E+01	2.30E+02	6.37E+01	3.30E+01	2.15E+02	6.74E+01	2.31E+02	1.63E+05	1.66E+04	5.13E+02	7.90E+03	6.90E+03
Chromium	ND	1.10E-01	1.04E-02	ND	1.40E-01	2.30E-02	ND	8.80E+02	7.80E+01		BACKGROUND	
Cobalt U				ND	2.30E-02	4.40E-03		BACKGROUND			BACKGROUND	
Copper	ND	4.00E-01	6.20E-02	3.40E-02	4.07E-01	1.24E-01	ND	1.20E+03	1.71E+02		BACKGROUND	
Iron U	2.20E-01	8.81E+01	1.00E+01	2.90E-01	1.91E+01	5.30E+00	1.20E+03	2.04E+04	6.90E+03	2.40E+03	2.71E+03	2.60E+03
Lead	6.70E-03	2.52E-01	3.00E-02	7.00E-03	1.30E-01	4.50E-02	2.40E+00	7.30E+02	7.40E+01		BACKGROUND	
Magnesium U	3.17E+00	8.00E+01	2.61E+01	6.07E+00	7.43E+01	3.16E+01	8.01E+00	6.34E+04	7.07E+03	3.21E+03	3.80E+03	3.52E+03
Manganese U	4.00E-02	3.00E+00	6.04E-01	2.30E-02	1.11E+00	4.00E-01		BACKGROUND		6.00E-01	1.11E+03	3.00E+02
Mercury	3.00E-04	1.10E-03	6.50E-04	ND	4.50E-04	8.00E-05	ND	3.00E+00	2.00E-01		BACKGROUND	
Nickel	ND	1.80E-01	3.00E-02	1.20E-02	3.20E-01	7.44E-02	ND	7.37E+02	7.51E+01		BACKGROUND	
Potassium U	1.80E+00	2.12E+01	7.47E+00	3.80E+00	2.00E+01	1.31E+01	ND	1.80E+04	4.20E+02	1.16E+02	1.73E+02	1.45E+02
Selenium							ND	3.20E+00	3.30E-01		BACKGROUND	
Silver	ND	2.00E-02	1.00E-03	ND	2.00E-02	1.00E-03	ND	1.10E+01	2.01E+00		BACKGROUND	
Sodium U	5.00E+01	7.60E+02	2.74E+02	4.43E+01	1.50E+03	3.00E+02	ND	1.00E+04	1.20E+03	1.20E+02	2.80E+02	2.10E+02
Thallium U	ND	7.00E-03	2.70E-03				ND	1.20E+00	1.10E-01		BACKGROUND	
Tin	ND	2.50E-02	7.40E-03				ND	4.70E+02	2.01E+01		BACKGROUND	
Vanadium	ND	5.00E-02	4.30E-03	ND	3.70E-02	6.70E-03		BACKGROUND			BACKGROUND	
Zinc	3.00E-02	3.80E-01	8.00E-02	7.20E-02	4.20E-01	1.25E-01	8.00E+00	1.24E+03	1.51E+02		BACKGROUND	
Acenaphthene U												
Acenaphthylene U												
Acetone U*	ND	2.50E-01	4.20E-02	ND	3.00E-01	5.30E-02	ND	2.20E+01	2.07E+00	2.80E-02	7.20E-02	4.00E-02
Anthracene U												
Benzene	ND	1.20E-02	1.47E-03				ND	1.40E-02	8.31E-04			
Benzo(a)anthracene							ND	1.80E-01	1.30E-02			
Benzo(a)pyrene							ND	1.60E-01	7.82E-03			
Benzo(b)fluoranthene U							ND	2.70E-01	1.20E-02			
Benzo(g,h,i)perylene U												
Benzoic acid U							ND	2.90E+01	3.24E+00			
Benzyl alcohol U												
Bis(2-chloroethyl)ether												
Bis(2-ethylhexyl)phthalate	ND	2.20E-03	2.44E-04				ND	1.80E-02	9.70E+00	7.10E-02	5.20E+00	2.04E+00
2-Butanone (MEK)	ND	1.80E-01	1.42E-02				ND	2.10E+01	2.00E+00	ND	2.00E-02	1.00E-02
Carbon disulfide												
Chlorobenzene												
Chlordane							ND	1.40E-01	6.00E-01			
Chloroethane U	ND	3.00E-02	5.00E-03	ND	2.20E-02	2.00E-03						
Chloroform							ND	2.20E-02	1.30E-03			
Chrysene U							ND	2.00E-01	1.24E-02			
Cresol	ND	1.40E-02	1.20E-03				ND	1.10E-01	8.00E-01			
4,4'-DDD							ND	8.00E-03	3.00E-04			
Dibenzo(a,h)anthracene U												
Dibenzofuran U												
1,4-Dichlorobenzene												
1,1-Dichloroethane	ND	7.20E-02	8.40E-03	ND	7.20E-02	8.62E-03						
1,2-Dichloroethane	ND	1.40E-02	1.27E-03	ND	8.00E-03	7.82E-04						
1,1-Dichloroethene												
Trans-1,2-dichloroethene	ND	8.70E-02	8.71E-03	ND	3.20E-02	5.64E-03	ND	2.00E-01	2.04E-03			
2,4-Dichlorophenol							ND	1.70E-01	2.71E-03			
2,4-Dimethylphenol U							ND	1.20E-01	7.14E-03			
Endrin U							ND	8.00E-02	9.82E-03			
Ethylbenzene	ND	4.20E-03	3.00E-04				ND	9.00E+00	3.22E-01			
Fluoranthene U							ND	3.00E+00	1.80E-01			
Fluorene U							ND	9.00E-02	4.67E-03			
Indeno(1,2,3-cd)pyrene U							ND	4.71E-02	2.34E-03			
Isophorone U	ND	2.00E-02	8.00E-03	ND	1.20E-02	1.44E-03	ND	1.80E-01	1.80E-02			
2-Methylnaphthalene U							ND	1.80E-01	8.80E-01			
Methylene chloride				ND	1.20E-01	1.20E-02	3.00E-03	3.00E+00	3.20E-01	2.40E-02	3.10E-02	2.75E-02
Naphthalene U							ND	7.40E+00	4.11E-01			
Nitrobenzene U*							ND	4.50E-02	2.14E-03			
N-Nitrosodiphenylamine U				ND	2.00E-03	2.20E-04	ND	2.00E-01	1.80E-03			
PCBs												
Pentachlorophenol U*												
Phenanthrene U							ND	9.00E+00	1.80E-01			
Phenol							ND	2.20E+00	1.70E-04			
Pyrene U				ND	2.00E-03	2.20E-04	ND	3.10E-01	2.00E-02			
Styrene U*							ND	6.00E-03	3.24E-04			
1,1,2,2-Tetrachloroethane							ND	6.00E-03	4.10E-04			
Tetrachloroethene												
Toluene	ND	4.40E-01	4.07E-02	ND	1.20E-02	1.10E-03	ND	1.20E-01	7.07E-01			
1,1,1-Trichloroethane	ND	2.20E-02	3.20E-03	ND	1.80E-02	1.20E-03	ND	1.20E-02	5.71E-03			
Trichloroethene	ND	1.80E-02	1.41E-03				ND	1.00E-02	7.80E-03			
Vinyl chloride	ND	1.30E-02	1.20E-03									
Xylene	ND	1.70E-01	1.80E-02	ND	1.70E-02	1.80E-03	ND	8.20E-01	1.01E+00			
2-Hexanone U							[illegible]	4.50E-02	4.07E-03			
4-Methyl-2-pentanone U*	ND	6.00E-02	1.10E-02				ND	8.40E+00	5.00E-01			
Diethyl phthalate U				ND	7.20E-03	8.30E-04						
Butyl benzyl phthalate U							ND	7.40E-01	1.80E-01			
Di-n-octyl phthalate							ND	1.20E-01	8.80E-01			
Cyanide U*	ND	3.20E-01	5.00E-02	ND	8.10E-03	1.80E-03	ND	6.40E-01	5.00E+00	ND	2.00E+00	1.00E+00
4-Chloro-3-methylphenol							ND	4.00E-01	1.80E-02			
N-nitrosodipropylamine												
Di-n-butylphthalate	ND	3.80E-03	3.22E-04	ND	8.00E-03	1.00E-04	ND	6.20E+00	4.04E-01			
Dieldrin							ND	3.20E+01	2.20E+00			
Aldrin												
Gamma-BHC(Lindane)												
AROCLOR-1242 & 1254												
AROCLOR-1248												
4,4'-DDT							ND	6.50E-03	4.37E-04			

WITHIN BACKGROUND RANGES FOR US SOIL - NOT CONSIDERED FURTHER
U = UNKNOWN, NO TOXICITY CONSTANTS FOR THE ENVIRONMENTAL MEDIA AVAILABLE
U* = REFERENCE DOSE AVAILABLE, THEREFORE, CONSIDERED IN THE FINAL HI VALUES

WORKSHEET 1. CONTINUED

NAME OF SITE: MOCO 1
DATE PREPARED: 3 MARCH 1987
ANALYST: SHARON LONG
VERIFIED BY: T. A. SCHALLER

UPDATED 14 OCTOBER 1987
BY: TAS

CHEMICAL	PHASE 1 SEDIMENTS (mg/kg)			PHASE 2 SEDIMENTS (mg/kg)			TRENCHES (mg/kg)		
	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN
Aluminum U	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Antimony	[illegible]	[illegible]	[illegible]				ND	[illegible]	[illegible]
Arsenic	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	ND	[illegible]	[illegible]
Barium	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	ND	[illegible]	[illegible]
Beryllium	ND	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	ND	[illegible]	[illegible]
Cadmium	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	ND	[illegible]	[illegible]
Calcium U	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Chromium	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cobalt U	ND	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	ND	[illegible]	[illegible]
Copper	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Iron U	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Lead	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Magnesium U	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Manganese U	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mercury	ND	[illegible]	[illegible]				ND	[illegible]	[illegible]
Nickel	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	ND	[illegible]	[illegible]
Potassium U	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Selenium	ND	[illegible]	[illegible]						
Silver	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]			
Sodium U	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Thallium U	ND	[illegible]	[illegible]						
Tin	[illegible]	[illegible]	[illegible]				ND	[illegible]	[illegible]
Vanadium	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	ND	[illegible]	[illegible]
Zinc	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Acenaphthene U	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Acenaphthylene U	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]			
Acetone U*	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Anthracene U	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Benzene				ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Benzo(a)anthracene	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Benzo(a)pyrene	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Benzo(b&k)fluoranthene U	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Benzo(g,h,i)perylene U	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Benzoic acid U	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Benzyl alcohol U									
Bis(2-chloroethyl)ether									
Bis(2-ethylhexyl)phthalate	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
2-Butanone (MEK)							ND	[illegible]	[illegible]
Carbon disulfide									
Chlorobenzene							ND	[illegible]	[illegible]
Chlordane	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Chloroethane U									
Chloroform				ND	[illegible]	[illegible]			
Chrysene U	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Cresol	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
4,4'-DDD									
Dibenzo(a,h)anthracene U	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Dibenzofuran U	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
1,4-Dichlorobenzene							ND	[illegible]	[illegible]
1,1-Dichloroethane	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]			
1,2-Dichloroethane	ND	[illegible]	[illegible]						
1,1-Dichloroethene				ND	[illegible]	[illegible]			
Trans-1,2-dichloroethene	ND	[illegible]	[illegible]				ND	[illegible]	[illegible]
2,4-Dichlorophenol									
2,4-Dimethylphenol U							ND	[illegible]	[illegible]
Endrin U							ND	[illegible]	[illegible]
Ethylbenzene							ND	[illegible]	[illegible]
Fluoranthene U	[illegible]	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Fluorene U	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Indeno(1,2,3-cd)pyrene U	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Isophorone U	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
2-Methylnaphthalene U	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Methylene chloride	[illegible]	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Naphthalene U	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Nitrobenzene U*									
N-Nitrosodiphenylamine U	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]			
PCBs	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Pentachlorophenol U*	ND	[illegible]	[illegible]				ND	[illegible]	[illegible]
Phenanthrene U	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Phenol				ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Pyrene U	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Styrene U*							ND	[illegible]	[illegible]
1,1,2,2-Tetrachloroethane									
Tetrachloroethene							ND	[illegible]	[illegible]
Toluene	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
1,1,1-Trichloroethane				ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Trichloroethene							ND	[illegible]	[illegible]
Vinyl chloride									
Xylene				ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
2-Hexanone U							ND	[illegible]	[illegible]
4-Methyl-2-pentanone U*							ND	[illegible]	[illegible]
Diethyl phthalate U	ND	[illegible]	[illegible]				ND	[illegible]	[illegible]
Butyl benzyl phthalate U	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Di-n-octyl phthalate	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Cyanide U*	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
4-Chloro-3-methylphenol				ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
N-nitrosodipropylamine							ND	[illegible]	[illegible]
Di-n-butylphthalate	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]
Dieldrin							ND	[illegible]	[illegible]
Aldrin							ND	[illegible]	[illegible]
Gamma-BHC(Lindane)									
AROCLOR 1242 & 1254	ND	[illegible]	[illegible]	ND	[illegible]	[illegible]			
AROCLOR 1248	ND	[illegible]	[illegible]						
4,4'-DDT									

U = UNKNOWN; NO TOXICITY CONSTANTS FOR THE ENVIRONMENTAL MEDIA AVAILABLE
U* = REFERENCE DOSE AVAILABLE, THEREFORE, CONSIDERED IN THE FINAL IS VALUES

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Table 2

TABLE 6-1
Standard Parameters Used for Calculation of Dosage and Intake

Parameter	Adult	Child age 6-12	Child age 2-6
Physical Characteristics			
Average Body Weight	70 kg (1,2)	29 kg (3)	16 kg (3)
Average Surface Area	18150 cm2 (1)	10470 cm2 (3)	6980 cm2(3)
Activity Characteristics			
Amount of Water Ingested Daily	2 liters (1)	1 liter (2)	1 liter (2)
Amount of Air Breathed Daily	20 m3 (1)	11 m3 (1)	6 m3 (1)
Amount of Fish Consumed Daily	6.5 g (1)		
Soil Ingested (Pica) Daily			1.0 g (1)
Frequency of Water Use for Swimming	7 days/yr (1)	7 days/yr (1)	
Duration of Exposure While Swimming	2.6 hrs/day (1)	2.6 hrs/day (1)	
Percentage of Surface Area Immersed While Bathing	0.8 (4)	0.8 (4)	0.8 (4)
Length of Exposure While Bathing	20 min (5)	20 min (5)	20 min (5)
Length of Additional Exposure After Bathing	10 min (5)	10 min (5)	10 min (5)
Amount of Air Breathed While Bathing	.55 m3 (1),(5)	.60 m3 (1),(5)	.40 m3 (1),(5)
Volume of Showerstall	3 m3 (5)	3 m3 (5)	3 m3 (5)
Volume of Bathroom	10 m3 (5)	10 m3 (5)	10 m3 (5)
Volume of Water Used While Showering	200 liters(5)	200 liters(5)	200 liters(5)
Material Characteristics			
Dust Adherence	0.51 mg/cm3 (6)		
Transfer Ratio of Contaminant From Water to Air	1/10000 (4)		
Mass Flux Rate (water-based)	0.2-0.5 mg/cm2/hr (1)		

(1) U.S. EPA, 1986a
(2) U.S. EPA, October 1986
(3) U.S. EPA, 1985d
(4) U.S. EPA, 1984b
(5) Symms, 1986
(6) Lepow, 1974

Table 3

Table 6-5
Potential Exposure Pathways for the Midco I Site

Transport Media	Source	Release Mechanism	Exposure Point	Exposure Route	Selected for Analysis
Air	On-site contaminated soil (via ground water)	Volatilization	On-site or off-site	Inhalation	Yes
	Off-site contaminated soil(via ground water)	Volatilization	Nearest residence	Inhalation	Yes
	Contaminated surface water	Volatilization	Nearest residence	Inhalation	Yes
	Contaminated groundwater	Volatilization during household use	Residential well	Inhalation	Yes
	Contaminated groundwater	Volatilization while showering/bathing	Residential well	Inhalation	Yes
	Contaminated soil	Fugitive dust generation	Site boundary	Inhalation	No - site capped or vegetated
Ground water	Contaminated soil	Leaching	Residential well	Ingestion	Yes
				Dermal	Yes
				Inhalation	Covered above (air media)
Surface water	Contaminated soil	Run-off	Grand Calumet R.	Ingestion	No - not a drinking water source
				Dermal	Yes
				Bioaccumulation	No - currently under investigation by U.S. Fish and Wildlife
	Contaminated ground water or surface water	Surface water recharge or discharge from the Grand Calumet R.	Lake Michigan	Ingestion	No - dilution capacity high
				Dermal	No - dilution capacity high
				Bioaccumulation	No - currently under investigation by U.S. Fish and Wildlife
	Contaminated ground water	Water table shallow	Wetlands area	Ingestion	No - not a drinking water source
				Dermal	Yes
				Bioaccumulation	No - currently under investigation by U.S. Fish and Wildlife
Soil	Contaminated surface soils	Episodic overland flows	Nearest off-site residence	Dermal	No - site capped
	Contaminated surface soils		On-site or off-site	Dermal	Yes
				Ingestion	Yes

Table 4

Table 6-8
Midco I

Routes of Exposure Used in Calculation of Intakes

Exposure Scenario/ Exposed Population	Exposed Subpopulation	Routes of Exposure Dermal	Ingestion	Inhalation
On-site	Child 6-12	Play in soil Play in surface water Bathing	Drinking water	Household air Bathing
	Child 2-6	Play in soil Bathing	Drinking water Pica	Household air Bathing
	Adult	Recreation in surface water Bathing	Drinking Water	Household air Bathing
Nearest Residence	Child 6-12	Play in soil Play in surface water		Household air
	Child 2-6	Play in soil	Pica	Household air
	Adult	Recreation in surface water		Household air

Table 5

Table 6-9
Midco 1
Characteristics of Subchronic/Chronic Exposure Scenarios

Route of Exposure	Media	Activity	Population	Subchronic Exposure Scenario Characteristics	Chronic Exposure Scenario Characteristics
Dermal	Soil	Play	Child age 6-12 Child age 2-6	Three exposure events (hands only with incidental ingestion of .1 g) at average concentration or one event at highest conc., whichever is greatest	One exposure event (hands only with incidental ingestion of .1 g) per day, 150 days per year, at average concentration
	Surface Water	Recreation (Wetlands area only)	Child age 6-12 Adult	Three hours of exposure (20% of body) at average concentration or one hour at highest concentration, whichever is greatest**	One hour of exposure (20% of body), 150 days per year, at average concentration
	Groundwater	Showering/ Bathing	Child age 6-12 Child age 2-6 Adult	One hour of exposure (80% of body) at average concentration or 20 min at highest concentration, whichever is greatest	20 minutes of exposure (80% of body) at average concentration 365 days/year
Ingestion	Soil	Pica	Child age 2-6	5 grams per day at average concentration or 2.5 grams at highest concentration, whichever is greatest	2.5 grams per day, 150 days per year, at average concentration
	Groundwater	Drinking water	Child age 6-12 Child age 2-6	3 liters at average concentration or 1 liter at highest concentration, whichever is greatest	1 liter per day, 365 days per year, at average concentration
			Adult	6 liters at average concentration or 2 liters at highest concentration, whichever is greatest	2 liters per day, 365 days per year, at average concentration

Table 6-9 (cont)
Midco 1
Characteristics of Subchronic/Chronic Exposure Scenarios

Inhalation	Combined Soil/ Surface Water Emission	Home	Child age 6-12 Child age 2-6	24 hours of exposure 300 meters from source at average predicted emission rate or 22 hours at highest predicted emission rate, whichever is greatest	18 hours of exposure, 365 days per year, 300 meters from source at average predicted emission rate
		Home	Adult	24 hours of exposure 300 meters from source at average predicted emission rate or 16 hours at highest predicted emission rate, whichever is greatest	16 hours of exposure, 365 days per year, 300 meters from source at average predicted emission rate
	Groundwater	Showering/ Bathing	Child age 6-12 Child age 2-6 Adult	One hour of exposure at average concentration or 20 min at highest concentration, whichever is greatest	20 minutes of exposure, 365 days per year at average concentration
		Home	Child age 6-12 Child age 2-6	18 hours of exposure at .0001 x the average groundwater conc. or 22 hours at .0001 x the highest concentration, whichever is the greatest	16 hours of exposure, 365 days per year, at .0001 x the average groundwater concentration
			Adult	24 hours of exposure at .0001 x the average groundwater conc. or 16 hours at .0001 x the highest concentration, whichever is the greatest	16 hours of exposure, 365 days per year, at .0001 x the average groundwater concentration

Table 6

TABLE 1-1a

WIDCO I

LOCATION-SPECIFIC REQUIREMENTS

LOCATION	REQUIREMENT AND CITATION	APPLICABILITY
Within 100 year floodplain	TSD facility must be designed, constructed, operated, and maintained to avoid washout (40 CFR 264.18(b))	Not applicable
Within floodplain	Action in floodplain to avoid adverse effects, minimize potential harm, restore and preserve natural and beneficial values (Executive Order 11988, Protection of Floodplains, (40 CFR 6, Appendix A))	Not applicable
Within salt dome formation, underground mine, or cave	RCRA hazardous waste placement of non-containerized or bulk liquid hazardous waste prohibited (40 CFR 264.18(c))	Not applicable
Within area where action may cause irreparable harm, loss, or destruction of significant artifacts	Action to recover and preserve artifacts (National Archeological and Historical Preservation Act (16 U.S.C. Section 469; 36 CFR Part 65)	Not applicable
Historic project owned or controlled by federal agency	Action to preserve historic properties; planning of action to minimize harm to National Historic Landmarks (National Historic Preservation Act Section 106 (16 U.S.C. 470 et seq.; 36 CFR Part 800)	Not applicable
Critical habitat upon which endangered species or threatened species depends	Action to conserve endangered species or threatened species, including consultation with the Department of Interior (Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.; 50 CFR Part 200, 50 CFR Part 402)	Not applicable
Wetland	Action to minimize the destruction, loss, or degradation of wetlands (Executive Order 11990, Protection of Wetlands, 40 CFR 6, Appendix A)	Applicable to wetlands on or near site
Wetland	Action to prohibit discharge of dredged or fill material into wetland without permit (Clean Water Act Section 404; 40 CFR Parts 230, 231)	Applicable to wetlands on or near site
Wilderness area	Federally-owned area designated as wilderness area must be administered in such manner as will leave it unimpaired as wilderness and to preserve its wilderness character (Wilderness Act (16 U.S.C. 1131 et seq.); 50 CFR 35.1 et seq.)	Not applicable
Wildlife refuge	Only action allowed under the provisions of 16 U.S.C. Section 668 dd(c) may be undertaken in areas that are part of the National Wildlife Refuge System (U.S.C. 668dd et seq.; 50 CFR Part 27)	Not applicable
Area affecting stream or river	Action during diversion, channeling or other activity that modifies a stream or river and affects fish or wildlife (Fish and Wildlife Coordination Act [16 U.S.C. 661 et. seq., 40 CFR 6.302])	Applicable to stream or river on or near site affected by remediation activities
Within area affecting national wild, scenic, or recreational river	Avoid taking or assisting in action that will have direct adverse effects of scenic river (Scenic Rivers Act (16 U.S.C. 1271 et seq. Sectin 7 (a)); 40 CFR 6.302 (e))	Not applicable
Within coastal zone	Conduct activities affecting the coastal zone in manner consistent with approved State management programs (Coastal Zone Management Act (16 U.S.C. Section 1451 et seq.))	Not applicable
Oceans or waters of the United States	Action to dispose of dredge and fill material is prohibited without a permit (Clean Water Act Section 404 CFR 125 Subpart M; Marine Protection Resources and Sanctuary Act Section 103)	Applicable to stream or river on or near site affected by remediation activities
Within 200 feet of fault displaced in Holocene time	New treatment, storage or disposal of hazardous waste prohibited (40 CFR 264.18(a))	Not applicable
Migratory bird flight pattern	Migratory Bird Treaty Act	Applicable to area affected by by remediation activities
Area affecting lakes and streams	Anadromous Fish Conservation Act	Applicable to lake or stream on or near site affected by remediation activities
Habitat for marine mammals	Marine Mammal Protection Act	Not applicable
Lake in Indiana	Lake Preservation Act (13-2-11.1)	Not applicable
Within floodplain in Indiana	Flood Control Act (13-2-22	Not applicable
Indiana habitat upon which nongame or endangered species depend	Nongame and Endangered Species Act (14-2-8)	Not applicable
Within Indiana nature preserve	Nature Preserves Act (14-4-5)	Not applicable

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Table 7

TABLE 1-15

MIDCO I
ACTION-SPECIFIC REQUIREMENTS

Page 1 of 9

Action	Requirement and Citation
Air Stripping	Proposed standards for control of emissions of volatile organics.
Capping	Placement of cap over waste requires a cover designed and constructed to: o Provide long-term minimization of migration of liquids through the capped area; o Function with minimum maintenance; o Promote drainage and minimize erosion or abrasion of the cover; o Accomodate settling and subsidence so that the cover's integrity is maintained; and o Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present. Eliminate free liquids by removal or solidification. Restrict use of property as necessary to prevent damage to cover. Prevent run-on and run-off from damaging cover. Stabilization of remaining waste to support cover. [40 CFR 264]
Consolidation	Placement on or in land outside unit boundaries or area of contamination will trigger land disposal requirements and restrictions. [40 CFR 268 (Subpart D)]

TABLE 1-15 (continued)

Page 2 of 9

Action	Requirement and Citation
Direct Discharge of Treatment System Effluent	Use of best available technology (BAT) economically achievable is required to control toxic and nonconventional pollutants. Use of best conventional pollutant control technology (BCT) is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. [40 CFR 122.44(a)]
	Applicable federally approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA. [40 CFR 122.44 and state regulations approved under 40 CFR 131]
	Applicable federal water quality criteria for the protection of aquatic life must be complied with when environmental factors are being considered. [50 FR 30784]
	The discharge must conform to applicable water quality requirements when the discharge affects a state other than the certifying state. [40 CFR 122.44(d)]
	The discharge must be consistent with the requirements of a Water Quality Management Plan approved by EPA. [40 CFR 122.44(d)]
	Discharge limitations must be established for all toxic pollutants that are or may be discharged at levels greater than that which can be achieved by technology-based standards. [40 CFR 122.44(e)]
	Develop and implement a BMP program and incorporate in the NPDES permit to prevent the release of toxic constituents to surface waters. [40 CFR 125.100]

TABLE 1-15 (continued)

Page 3 of 9

Action	Requirement and Citation
	The BMP program must: o Establish specific procedures for the control of toxic and hazardous pollutant spills; o Include a prediction of direction, rate of flow, and total quantity of toxic pollutants where experience indicates a reasonable potential for equipment failure; and o Assure proper management of solid and hazardous waste in accordance with regulations promulgated under RCRA. [40 CFR 125.104]
	Discharge must be monitored to assure compliance. [40 CFR 122.44(i)]
	Approved test methods for waste constituents to be monitored must be followed. Detailed requirements for analytical procedures and quality controls are provided.
	Sample preservation procedures, container materials, and maximum allowable holding times are prescribed. [40 CFR 136.1-136.4]
	Permit application information must be submitted including a description of activities, listing of environmental permits, etc. [40 CFR 122.21]
	Monitor and report results as required by permit. [40 CFR 122.44(i)]
	Comply with additional permit conditions. [40 CFR 122.41(i)]

TABLE 1-15 (continued)

Page 4 of 9

Action	Requirement and Citation
Discharge to POTW	Pollutants that pass through the POTW without treatment, interfere with POTW operation, or contaminate POTW sludge are prohibited. Specific prohibitions preclude the discharge of pollutants to POTWs that: o Create a fire or explosion hazard in the POTW; o Are corrosive (pH <5.0); o Obstruct flow resulting in interference; o Are discharged at a flow rate and/or concentration that will result in interference; o Increase the temperature of wastewater entering the treatment that would result in interference but in no case raise the POTW influent temperature above 104°F; Discharge must comply with local POTW pretreatment program; and [40 CFR 403.5 and local POTW regulations] RCRA permit-by-rule requirements must be complied with for discharges of RCRA hazardous wastes to POTWs by rail, truck, or dedicated pipe. [40 CFR 264.71 and 264.72]
Discharge of Dredge and Fill Material to Navigable Waters	The four conditions that must be satisfied before dredge and fill is an allowable alternative are: o There must be no practicable alternative; o Discharge of dredged or fill material must not cause a violation of state water quality standards, violate any applicable toxic effluent standards, jeopardize an endangered species, or injure a marine sanctuary;

TABLE 1-15 (continued)

Page 5 of 9

Action	Requirement and Citation
	o No discharge shall be permitted that will cause or contribute to significant degradation of the water; o Appropriate steps to minimize adverse effects must be taken; and o Determine long- and short-term effects on physical, chemical, and biological components of the aquatic ecosystem. [40 CFR 230.10 and 33 CFR 320-330]
Excavation	Movement of excavated materials containing RCRA hazardous wastes to new location and placement in or on land will trigger land disposal restrictions.
Ground Water Diversion	Excavation of RCRA hazardous waste for construction of slurry wall may trigger cleanup or land disposal restrictions.
Incineration (On-Site)	Analyze the RCRA hazardous waste feed [40 CFR 264.341] Dispose of all hazardous waste and residues including ash, scrubber water, and scrubber sludge. [40 CFR 264.351] Performance standards for incinerators: o Achieve a destruction and removal efficiency of 99.99 percent for each principal organic hazardous constituent in the waste feed; and [40 CFR 264.343] o Reduce hydrogen chloride emissions to 1.8 kg/hr or 1 percent of the HCL in the stack gases before entering any pollution control devices. [40 CFR 264.342]

TABLE 1-15 (continued)

Page 6 of 9

Action	Requirement and Citation
	Monitoring of various parameters during operations of the incinerator is required. These parameters include: o Combustion temperature; o Waste feed rate; o An indicator of combustion gas velocity; and o Carbon monoxide.
	Special performance standard for incineration of PCBs. [40 CFR 7611.70]
	Special requirements for incineration by Indiana Department of Environmental Management, including a trial burn and extensive sampling.
Land Treatment	Ensure that hazardous constituents are degraded, transformed, or immobilized within the treatment zone. [40 CFR 264.271]
	Maximum depth of treatment zone must be no more than 50 feet from the initial soil surface, and more than 3 feet above the seasonal high water table. [40 CFR 264.271]
	Demonstrate that hazardous constituents for each waste can be completely degraded, transformed, or immobilized in the treatment zone. [40 CFR 264.271]
	Minimize run-off of hazardous constituents. [40 CFR 264.273]
	Maintain run-on and run-off controls and management system. [40 CFR 264.273]
	Unsaturated zone monitoring. [40 CFR 264.281]
	Special requirements for ignitable or reactive waste. [40 CFR 264.282]

TABLE 1-15 (continued)

Action	Requirement and Citation
	Special requirements for incompatible wastes. [40 CFR 264.282]
	Special requirements for F020, F021, F022, F023, F026, and F027 wastes. [40 CFR 264.283]
Slurry Wall	Excavation of RCRA hazardous waste for construction of slurry wall may trigger cleanup or land disposal restrictions. [40 CFR 268]
Treatment	Proposed standards for miscellaneous units require new units to satisfy environmental performance standards by protection of ground water, surface water, and air quality, and by limiting surface and subsurface migration.
	Treatment of wastes subject to ban on land disposal must attain levels achievable by best demonstrated available treatment technologies (BDAT) for each hazardous constituent in each listed waste. [40 CFR 268.10-13]
	BDAT standards for spent solvent wastes are based on one of four technologies. Any technology may be used; however, if it will achieve the concentration levels specified. [RCRA Sections 3004(d)(e).(e)(3) 42 U.S.C. 6924(d)(3).(e)(3)]
Underground Injection of Wastes and Treated Ground Water	UIC program prohibits: [40 CFR 144.12] o Injection activities that allow movement of contaminants into underground sources of drinking water and results in violations of MCLs or adversely affects health; and o Construction of new Class IV wells, and operation and maintenance of existing wells. [40 CFR 144.13]

TABLE 1-15 (continued)

Page 8 of 9

Action	Requirement and Citation
	Wells used to inject contaminated ground water that has been treated and is being reinjected into the same formation from which it was drawn are not prohibited if activity is part of CERCLA action. [40 CFR 144.13]
	All hazardous waste injection wells must comply with the RCRA requirements. [40 CFR 144.16]
	Owners and operators must: [40 CFR 144.26-27]
	o Submit inventory information to the director of the state UIC program;
	o Report non-compliance orally within 24 hours; and
	o Prepare, maintain and comply with plugging and abandonment plan.
	Monitor Class I wells by:
	o Frequent analysis of injection fluid;
	o Continuous monitoring of injection pressure;
	o flow rate and volume; and
	o Installation and monitoring of ground water monitoring wells.
	Applicants for Class I permits must: [40 CFR 144.55]
	o Identify all injection wells within the area of review; and
	o Take action as necessary to ensure that such wells are properly sealed, completed, or abandoned to prevent contamination of USDW.

TABLE 1-15 (continued)

Page 9 of 9

Action	Requirement and Citation
	Criteria for determining whether an aquifer may be determined to be an exempted aquifer include current and future use, yield, and water quality characteristics. [40 CFR 146.4]
	Case and cement all Class I wells to prevent movement of fluids into USDW, taking into consideration well depth, injection pressure, hole size, composition of injected waste and other factors.
	Conduct appropriate logs and other tests during construction and a descriptive report prepared and submitted to the UIC Program Director.
	Injection pressure may not exceed a maximum level designed to ensure that injection does not initiate new fractures or propagate existing ones and cause the movement of fluids into a USDW. [40 CFR 146.13]
	Continuous monitoring of injection pressure, flow rate, and volume, and annual pressure, if required.
	Demonstration of mechanical integrity is required every 5 years.
	Ground water monitoring may also be required.

Table 8

TABLE 4-10

ALTERNATIVES' COMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS

Law or Regulation	Comment	Alternative 1	2	3	4A	4B	4C	4E	5A	5C	5E	5G	6	7	8	9
FEDERAL																
Resource Conservation and Recovery (RCRA) - Subtitle C																
40 CFR 262 Standard for Generators	Alternative will involve treatment/disposal of hazardous waste. RCRA generator regulations apply.				x	x	x	x	x	x	x		x	x	x	x
40 CFR 264-265 Standards for owners and operators of hazardous waste treatment, storage and disposal facilities.	Alternative will require use of a RCRA-permitted facility in compliance with current RCRA regulations.				x	x	x	x	x	x	x	x	x	x	x	x
DOT Hazardous Materials Transport Rules (49 CFR Subchapter C) and RCRA - Subtitle C Standards for Transporters 40 CFR 263	Implementation of this alternative includes the off-site transport of hazardous materials. The transport of these materials will be in compliance with these rules, including use of properly constructed and marked transport vehicles, use of a licensed transporter, and use of hazardous waste manifests.				x	x	x	x	x	x	x		x	x	x	x
Clean Water Act (CWA)																
40 CFR Parts 122, 125 and Subpart N National Pollutant Discharge Elimination System (NPDES)	Indiana has authorization to administer NPDES in Indiana. Refer to section on state regulation.															
40 CFR 403 Effluent Guidelines and Standards - Pretreatment Standards	Indiana has authorization to administration pretreatment in Indiana Refer to section on state regulations.															
Federal Water Quality	Alternatives may not result in compliance with FWQC in surface water.	x	x						x	x	x	x				
EPA Ground Water Protection Strategy	This alternative will not attain EPA's ground water protection strategy goals for aquifer.	x	x						x	x	x	x				
Occupational Safety & Health Act (OSHA) Part 1910 (OSHA Standards)	Implementation of this alternative will require work on the site. Working conditions must assure safety and health of workers.		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Toxic Substances Control Act (TSCA) 40 CFR 761	Alternative may require disposal of PCB-contaminated material; however, PCB levels are not at concentrations triggering disposal requirements.			x					x	x	x	x	x	x	x	x
Intergovernmental Review of Federal Programs 40 CFR 29	Alternative will require intergovernmental review of project if project will use federal funds.		x	x	x	x	x	x	x	x	x	x	x	x	x	x
National Primary Drinking Water Standards	Alternative will not result in compliance with standards	x	x						x	x	x	x				
Ambient Water Quality Criteria	Alternative will not result in compliance with criteria.	x	x						x	x	x	x				

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TABLE 6-10

ALTERNATIVES' COMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS

Law or Regulation	Comment	Alternative 1	2	3	4A	4B	4C	4E	5A	5C	5E	5G	6	7	8	9
Clean Air Act (CAA)	Implementation of this alternative may result in the emission of pollutants into the air though below regulatory limits. A Permit should not be required, but necessary technical requirements will be met.					x	x	x	x	x	x	x	x	x	x	x
	On-site excavation may result in the short-term emission of particulates. On-site personnel will be adequately protected. Efforts to mitigate release will be made.			x					x	x	x		x	x	x	x
Safe Drinking Water Act, Underground Injection Control (UIC) Program: Criteria and Standards (40 CFR Part 146)					x	x	x	x	x					x	x	
Underground Injection Well Permit					x	x	x							x	x	
Marine Protection, Research and Sanctuaries Act (40 CFR Part 220-229) Ocean Dumping Requirements	Implementation of the alternatives does not include the dumping of any materials in the ocean or incineration at sea.															
Radioactive Waste Rule -- High Low Level	Existing records indicate that the site does not contain high- or low-level radioactive waste.															
National Register of Historic Places	Implementation of the alternatives will not affect sites on the register.															
Wild and Scenic Rivers Act (40 CFR Part 6.302)	Rivers on the national inventory will not be affected by alternatives.															
Endangered Species Act Protection of Threatened or Endangered Species and Their Habitats (50 CFR Part 402)	Implementation of the alternatives will not affect threatened or endangered species and their habitat.															
Fish and Wildlife Act Conservation of Wildlife Resources	Implementation of the alternatives will not affect areas of important wildlife resources.															
Coastal Zone Management Act (15 CFR 920-926)	Implementation of the alternatives will not affect a coastal zone.															
Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1979 (40 CFR 4)	Implementation of the alternatives should not require relocation of residences or businesses or acquisition of property.															
Executive Orders for Flood Plain (EO11988)	Implementation of this alternative will not occur in a flood plain.															
Executive Orders for Wetlands (EO11990)	Implementation of this alternative may affect a wetland.			x	x	x	x	x	x	x	x	x	x	x	x	x
National Environmental Policy Act (NEPA)	CERCLA actions are exempted from NEPA requirements.															
Archaeological and Historic Preservation Act of 1974	Alternatives should not affect these resources.															

TABLE 4-10

ALTERNATIVES' COMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS

Law or Regulation	Comment	1	2	3	4A	4B	4C	4E	5A	5C	5E	5G	6	7	8	9
STATE																
Indiana Hazardous Waste Management Program - Indiana Environmental Management Board Article 4 (320-IAC-4)																
Rules 2, 3, 4, Waste Generation Identification Standards for Generators	This alternative will involve off-site disposal of hazardous waste and generator regulations apply.					x	x	x	x						x	x
Rule 5 Standards Applicable	Implementation of this alternative includes the off-site transport of hazardous materials. The transport of these materials will be in compliance with these rules, including use of properly constructed and marked transport vehicles, use of licensed transporters, and use of hazardous waste manifests.					x	x	x	x						x	x
Rule 6 Standards Applicable to Owners and Operators of Hazardous Waste Facilities				x	x	x	x	x	x	x	x	x	x	x	x	x
Rule 7 Closure/Postclosure	This alternative will be consistent with current state regulations although no permit will be required.			x	x	x	x	x	x	x	x	x	x	x	x	x
Rule 8-9 Hazardous Waste Facility Construction and Operating Permit	This alternative will require the use of a state-permitted facility in compliance with current state regulations.			x	x	x	x	x	x	x	x	x	x	x	x	x
Indiana Waste Treatment Facilities Regulation - Title 330 - Article 3.1 Facility Construction	This alternative will require construction of a waste treatment facility and will be consistent with the technical requirement of Article 3.1.					x	x	x		x	x				x	x
Article 5 Industrial Waste-water Pretreatment and NPDES Programs - Rules 1 - 10	Implementation of alternative will not result in an on-site point source discharge. An NPDES permit will not be required.															
Rules 11-15 Pretreatment Standards	Not applicable. Implementation of alternatives will not result in discharge of a waste stream to a publicly-owned treatment works (POTW).															
Indiana Water Quality Standards Stream Pollution Control Board 330 IAC Article 1-2, Section 6 Water Quality Standard	Implementation of alternatives will not result in noncompliance with Indiana Water Quality Standards.															
Indiana Air Pollution Control	Alternatives will be consistent with the technical requirement of current Indiana regulation.		x	x	x	x	x	x	x	x	x	x	x	x	x	x
LOCAL																
Zoning	Alternatives may require no zoning change.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

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TABLE 9

COMPARISON OF CONCENTRATIONS OF INORGANICS IN SUBSURFACE MATERIAL AT MIDCO I WITH CONCENTRATIONS IN LISTED HAZARDOUS WASTE (FROM BOAT BACKGROUND DOCUMENTS FOR THE FIRST THIRD WASTES UNDER LAND BAN)

	CONSTITUENT CONCENTRATIONS (mg/kg)			
Source	Arsenic	Chromium	Lead	Cadmium
K101	590-1950			
K102	3060-8320			
K061		1730	20300	44
K046		-	967	
K048		0.04-3435	0.06-1250	
K049		28.9-1400	21.95-3900	
K050		11-1600		
K051		0.1-6790	0.25-2480	
K052			11-5800	
Midco I On-Site Soils	ND-49	2.2-10200	2.8-4980	ND-12

Table 10

TABLE 4-2

[illegible] I

EFFECTIVENESS EVALUATION OF ALTERNATIVES

	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT SHORT TERM	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT LONG TERM	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME
Alternative 1	Does not reduce potential public health risk associated with contaminated soils if excavated and exposed or ground water if ingested. Would not comply with chemical and location-specific requirements as well as criteria, advisories and guidance.	Public health risk exists for ingestion or dermal absorption of excavated soils and ground water contaminants, for dermal absorption of surface water and for inhalation of compounds volatilized from ground water. Increased lifetime cancer risk to future on-site residents (4.5×10^{-4}) is unacceptable. Future exposure to residual contaminants cannot be prevented.	Toxicity, mobility, or volume of contaminants in soil and ground water are not permanently or significantly reduced.
Alternative 2	Existing risks would be reduced for on-site soil and ground water ingestion and dermal absorption. This requires successful enforcement of deed restrictions and maintenance of the site, fencing, and erosion protection. Potential for contaminated ground water degradation would be lessened by inhibiting surface moisture infiltration (and thus, contact with potential contaminants). Risks to the workers and the community during remedial action can be adequately controlled by restricting access to site to authorized personnel only, and conducting action with adequate health and safety precautions. Final protection from exposure to on-site contamination is achieved upon completion of cap construction, approximately 1 year after initiation of construction.	Cleanup action levels (CALs) for soil and ground water will not be met as soil remains without treatment and ground water that has migrated off site will not be treated. Continued potential for ground water degradation exists due to lateral ground water migration. Surface water contaminants may be worsened by continual discharge of contaminated ground water. Deed restrictions and site maintenance are provided. Need for replacement will be based on site maintenance over time. Performance of properly installed multi-layered cap is generally good for first 20 years of service. Integrity of synthetic liner after this time becomes uncertain and should be investigated regularly. Punctures of the liner by deep rooted plants and burrowing animals will affect the performance of the cap. If remedial action fails, risk is similar to no-action alternative. The cost for remedying failure would be similar to the cost of original installation if it is detected before more ground water moves off site and if the area needing repair could be located. If not, cost to remedy will involve, as a minimum, a ground water option to remove the escaping contaminants. Contamination may move vertically through to the next aquifer. This aquifer has very little yield, and is not used for drinking water purposes. Monitoring of the confining layer should detect movement. A ground water extraction system could be employed if warranted by sampling. Costs would be similar to ground water options. Without ground water use restrictions, the remaining risk at the site after remediation completion is 4.5×10^{-2}. With enforcement of ground water use restrictions, all risks would be reduced below acceptable levels.	Reduces mobility of contaminants in soil but does not significantly or permanently reduce toxicity or volume or reduce the mobility of contaminants that are already in the ground water.

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TABLE 4-2

[illegible] I

EFFECTIVENESS EVALUATION OF ALTERNATIVES

	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT SHORT TERM	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT LONG TERM	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME
Alternative 3	Safety concern during installation related to excavation activities. Risks to workers and community during remedial action, can be adequately controlled by restrict-ing access to the site to authorized personnel only, and conducting action with adequate health and safety precautions. Protection against principle threat can be achieved upon completion of construction, approximately 1 to 2 years.	Cleanup action levels (CALs) for soil and ground water will not be met because no treatment is provided for either. Eliminates direct contact exposure to contaminants. Contamination may move vertically to next aquifer. This aquifer has very little yield, and is not used for drinking water purposes. Monitoring of the confining layer should detect movement. A ground water extraction system could be employed if warranted by sampling. Costs would be similar to ground water options. Long-term access restriction would prevent future exposure to residuals. In contaminated environment, effectiveness over long-term depends on type of contaminants and concentrations. High salt and organic concentrations may effect permeability of wall, resulting in need to replace system in long term. If failed, risks are similar to no-action. The cost for remedying failure would be similar to, but higher than, the cost of original installation if it is detected before more ground water moves off site and if the area needing repair could be located. If not, cost to remedy will involve, as a minimum, a ground water option to remove the escaping contaminants. After remediation is completed, all risks are reduced below acceptable levels.	Significantly reduces mobility of contaminants in soil and ground water, but does not reduce toxicity or volume.
Alternative 4A	Protection will be achieved by interception of ground water, capping, deed restriction, and site maintenance. Remedial action activities may not commence for 1 to 2 years, as a Petition Demonstration for deep well must be approved by EPA. Construction of remedial action should take 2 years. Risks to workers and community during remedial action can be adequately controlled by restricting access to site to authorized personnel only and conducting action with adequate health and safety precautions.	Cleanup action levels (CALs) for soil will not be met as soil remains without treatment. The ground water that has migrated off site will be removed where CALs are exceeded and ground water CALs on site would be met. A cap and access restriction will prevent soil ingestion and dermal absorption. Potential for failure of technical components is small, but will require routine maintenance and replacement. If failed, risks at site are similar to no-action. If contaminants leave deep aquifer, cost to remedy will be many times the cost of original remediation due to great depth and difficulty of monitoring. After remediation is completed, if deed restriction and site maintenance are performed, all risks are reduced below acceptable levels.	Significantly and permanently reduces mobility of contaminants in the soil but does not reduce toxicity or volume of some contaminants in soil. Significantly and permanently reduces mobility of contaminants in ground water but does not reduce toxicity or volume.
Alternative 4B	Protection will be achieved by interception of ground water, capping, deed restriction, and site maintenance. Remedial action activities may not commence for at least 1 year, as approval for this option must be obtained. Construction of remedial action should take 2 years. Risks to workers and community during remedial action can be adequately controlled by restricting access to site to authorized personnel only and conducting action with adequate health and safety precautions.	Cleanup action levels (CALs) for soil will not be met as soil remains without treatment. The ground water that has migrated off site will be removed where CALs are exceeded and ground water CALs on site would be met. A cap and access restriction will prevent soil ingestion and dermal absorption. Technical components of remedy will require routine operation, maintenance and replacement. If fails, risks at site are similar to no-action. If contaminants leave deep aquifer, cost to remedy will be many times the cost of original remediation due to great depth and difficulty of monitoring. After remediation is completed, if deed restrictions and site maintenance are performed, all risks are reduced below acceptable levels.	Significantly and permanently reduces mobility of contaminants in the soil but does not reduce toxicity or volume of some contaminants in soil. Significantly and permanently reduces mobility and toxicity of contaminants in ground water but does not reduce volume. Some contaminants in ground water are transferred to carbon canisters which are disposed of off site. Does not significantly or permanently reduce toxicity or mobility of these residuals.

TABLE 4-2

MIDCO I

EFFECTIVENESS EVALUATION OF ALTERNATIVES

	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT SHORT TERM	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT LONG TERM	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME
Alternative 4C	Protection will be achieved by interception of ground water, capping, deed restriction, and site maintenance. Approval for this option should not unduly slow action down as contaminants will be removed to drinking water quality except salinity before injection. Construction of remedial action should take 2 years. Risks to workers and community during remedial action can be adequately controlled by restricting access to site to authorized personnel only and conducting action with adequate health and safety precautions.	Cleanup action levels (CALs) for soil will not be met as soil remains without treatment. The ground water that has migrated off site will be removed where CALs are exceeded and ground water CALs on site would be met. The level of acetone being injected into the deep well may exceed the CAL. No MCL or MCLG presently exists for acetone. A cap and access restriction will prevent soil ingestion and dermal absorption. Potential for failure of technical components is increased due to further complexity of treatment processes and will require regular operation, maintenance, and replacement. If fails, risks at site are similar to no-action. If water leaves deep aquifer, since this is not a drinking water aquifer, the increased salinity should not pose a problem. After remediation is completed, if deed restrictions and site maintenance are performed, all risks are reduced below acceptable levels.	Significantly and permanently reduces mobility of contaminants in the soil but does not reduce toxicity or volume of some contaminants in soil. Significantly and permanently reduces mobility and toxicity of contaminants in ground water but does not reduce volume. Some contaminants in ground water are transferred to carbon canisters and metals sludges which are disposed of off site. Does not significantly or permanently reduce toxicity or mobility of these residuals.
Alternative 4E	Protection against principle threat will be achieved by interception of ground water, capping, deed restriction and site maintenance. Approval for the evaporator system should be readily obtainable as this is conventional technology. Construction of remedial action should take 1 to 2 years. Risk to workers and community during remedial action can be adequately controlled by restricting access to site and conducting action with adequate health and safety precautions.	Cleanup action levels (CALs) for soil will not be met as soil remains without treatment. The ground water that has migrated off site will be removed where CALs are exceeded and ground water CALs on site would be met. A cap and access restriction will prevent soil ingestion and dermal absorption. Technical components of action should not fail with adequate operation and maintenance. After remediation is completed, if deed restrictions and site maintenance are performed, all risks are reduced below acceptable levels.	Significantly and permanently reduces mobility of contaminants in the soil but does not reduce toxicity or volume of some contaminants in soil. Significantly and permanently reduces mobility, toxicity, and volume of contaminants in ground water. Some contaminants in ground water are transferred to salt crystals which are disposed of off site. Does not significantly or permanently reduce toxicity or mobility of these residuals.
Alternative 5A	Safety concerns during the remedial action are related to the excavation of the material. Risk to the workers and the community can be adequately controlled by restricting access to the site and conducting action with adequate health and safety precautions.	Cleanup action levels for soils above ground water level would be met. CALs for soils below ground water may not be met; however, risk calculations are based on ingestion of soil, and these additional solids would be below the water table and unavailable for ingestion. Attenuation results in a dissipation of contaminants, although it will be many years before ground water cleanup action levels will be attained for all compounds. Future exposure to residuals is minimized, because material removed from site. Remedial alternative transfers the problems to the landfill. Without ground water use restrictions, the remaining risk at the site after remediation completion is 6.5×10^{-2}. With enforcement of ground water use restrictions, all risks would be reduced below acceptable levels.	Reduces volume of contaminants in soil by removing it from site but transfers the problem to the landfill site. Does not reduce volume, mobility or toxicity of contaminants in ground water.

TABLE 6-7

[illegible]

EFFECTIVENESS EVALUATION OF ALTERNATIVES

	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT SHORT TERM	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT LONG TERM	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME
Alternative 5C	Safety concerns during the remedial action are related to the excavation of the material. Risk to the workers and the community can be adequately controlled by restricting access to the site and conducting action with adequate health and safety precautions, and providing adequate emissions control. It will be necessary to perform treatability studies to adequately demonstrate that the solidified ash can conform to procedures similar to delisting. Due to extensive technical requirements/submittals (including a trial burn) as well as the backlog at IDEM, remediation of the soils may not begin for up to 2 years. Completion of construction should be less than 1 year. The actual soil remediation should be less than 1 year.	Cleanup action levels for soils above ground water level would be met. CALs for soils below ground water may not be met; however, risk calculations are based on ingestion of soil, and these additional solids would be below the water table and unavailable for ingestion. Attenuation results in a dissipation of contaminants, although it will be many years before ground water cleanup action levels will be attained for all compounds. Future exposure to residuals would be minimal. If fails, risks are similar to no action. The cost for remedying failure of solidification would be similar to the cost of original installation. Without ground water use restrictions, the remaining risk at the site after remediation completion is 4.5×10^{-2}. With enforcement of ground water use restrictions, all risks would be reduced below acceptable levels.	Significantly and permanently reduces toxicity and mobility of contaminants in soil, but does not reduce toxicity, mobility of volume of contaminants in ground water.
Alternative 5E	Safety concern during installation associated with excavation and mixing of contaminated material. Risk to workers and community during remedial action can be adequately controlled by restricting access and conducting actions with adequate health and safety precautions. It will be necessary to perform treatability studies to adequately demonstrate that the solidified soil can conform to procedures similar to delisting. This may delay initiation of construction. Completion of construction should be 1 year.	Cleanup action levels for soils above ground water level would be met. CALs for soils below ground water may not be met; however, risk calculations are based on ingestion of soil, and these additional solids would be below the water table and unavailable for ingestion. Attenuation results in a dissipation of contaminants, although it will be many years before ground water cleanup action levels will be attained for all compounds. Future exposure to residuals would be minimal. If treatability studies are properly conducted, there should be a lower likelihood for needing replacement. If fails, risks are similar to no action. The cost for remedying failure would be similar to the cost of original installation. Without ground water use restrictions, the remaining risk at the site after remediation completion is 4.5×10^{-2}. With enforcement of ground water use restrictions, all risks would be reduced below acceptable levels.	Significantly and permanently reduces mobility of contaminants in soil, but does not reduce toxicity, mobility or volume of contaminants in ground water.

TABLE 4-2

ROUND 1

EFFECTIVENESS EVALUATION OF ALTERNATIVES

	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT SHORT TERM	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT LONG TERM	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME
Alternative 5C	Because no excavation of materials occurs and all of the materials are treated in a hood, risk is minimized. Risk to workers and community during remedial action can be adequately controlled by restricting access and providing adequate health and safety precautions. Completion of construction should be 1 to 2 years.	Cleanup action levels for soils above ground water level would be met. CALs for soils below ground water may not be met; however, risk calculations are based on ingestion of soil, and these additional solids would be below the water table and unavailable for ingestion. Attenuation results in a dissipation of contaminants, although it will be many years before ground water cleanup action levels will be attained for all compounds. Alternative has been evaluated on pilot scale. Technology has not been proven on full scale project. Therefore need for replacement is unknown at this time. This option may preclude some types of future remedial action due to creation of solid monolith. Future exposure to residuals would be minimal. If treatability studies are properly conducted, there should be a lower likelihood for needing replacement. The cost for remedying failure would be similar to the cost of original installation. Without ground water use restrictions, the remaining risk at the site after remediation completion is 6.5×10^{-2}. With enforcement of ground water use restrictions, all risks would be reduced below acceptable levels.	Significantly and permanently reduces toxicity, mobility and volume of contaminants in soil, but does not reduce toxicity, mobility, or volume of contaminants in ground water.
Alternative 6	Protection achieved by containment and solidification. It will be necessary to perform treatability studies to demonstrate that the solidified waste can conform to procedures similar to RCRA delisting. This may delay construction initiation. Construction of remedial action would take 1 to 2 years. Risks to the workers and the community during remedial action can be adequately controlled by restricting access to the site to authorized personnel only and conducting action with adequate health and safety precautions.	Combines the long-term effectiveness of Alternatives 3 and 5C. Cleanup action levels for soil above ground water will be met. CALs for soil below ground water may not be met; however, risk calculations are based on ingestion of soil, and this would be unavailable for ingestion. Ground water cleanup action levels would not be met on site. Contamination may move vertically to next aquifer. Monitoring of the confining layer should detect movement. A ground water extraction system could be employed if warranted by sampling. Costs would be similar to ground water options. The cost for remedying failure would be similar to but higher than the cost of original installation if it is detected before more ground water moves off site and if the area needing repair could be located. If not, cost to remedy will involve, as a minimum, a ground water option to remove the escaping contaminants. After remediation is completed, all risks are reduced below acceptable levels.	Significantly and permanently reduces mobility of contaminants in soil and ground water.

TABLE 4-7

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EFFECTIVENESS EVALUATION OF ALTERNATIVES

	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT SHORT TERM	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT LONG TERM	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME
Alternative 7	Protection against principle threat will be achieved by ground water interception and solidification. Remedial action activities for ground water may not commence for 1 to 2 years as a Petition Demonstration for the deep well must be approved. It will be necessary to perform treatability studies to demonstrate that the solidified waste can conform to procedures similar to RCRA delisting. This may delay construction initiation. Construction of the remedial action would take approximately 2 years. Risks to the workers and the community during remedial action can be adequately controlled by restricting access to the site to authorized personnel only and conducting action with adequate health and safety precautions.	Combines the long-term effectiveness of Alternatives 4A and 5E. Cleanup action levels for soil above ground water will be met. CALs for soil below ground water may not be met; however, risk calculations are based on ingestion of soil, and this would be unavailable for ingestion. Ground water cleanup action levels would be met. If contaminants leave deep aquifer, cost to remedy will be many times the cost of original remediation due to great depth and difficulty of monitoring. After remediation is completed, all risks are reduced below acceptable levels.	Permanently and significantly reduces mobility of contaminants in soil and ground water.
Alternative 8	Protection will be achieved by ground water interception/treatment and solidification. Approval for this option should not unduly slow action down as contaminants will be removed to drinking water quality except salinity before injection. It will be necessary to perform treatability studies to demonstrate that the solidified waste can conform to procedures similar to RCRA delisting. This may delay construction initiation. Construction of remedial action would take 2 years. Risks to the workers and the community during remedial action can be adequately controlled by restricting access to the site to authorized personnel only and conducting action with adequate health and safety precautions.	Combines the long-term effectiveness of Alternatives 4C and 5E. Cleanup action levels for soil above ground water will be met. CALs for soil below ground water may not be met; however, risk calculations are based on ingestion of soil, and this would be unavailable for ingestion. Ground water cleanup action levels would be met. If water leaves deep aquifer, since this is not a drinking water aquifer, the increased salinity should not pose a problem. After remediation is completed, all risks are reduced below acceptable levels.	Significantly and permanently reduces mobility of contaminants in soil and the mobility and toxicity of contaminants in ground water. Some contaminants in ground water are transferred to carbon canisters and the metals sludges which are disposed of off site. Does not significantly or permanently reduce toxicity or mobility of these residuals.
Alternative 9	Protection will be achieved by ground water interception/evaporation and solidification. Approval for the evaporator system should be readily obtainable as this is conventional technology. It will be necessary to perform treatability studies to demonstrate that the solidified waste can conform to procedures similar to RCRA delisting. This may delay construction initiation. Construction of remedial action should take 1 to 2 years. Risks to the workers and the community during remedial action can be adequately controlled by restricting access to the site to authorized personnel only and conducting action with adequate health and safety precautions.	Combines the long-term effectiveness of Alternatives 4E and 5E. Cleanup action levels for soil above ground water will be met. CALs for soil below ground water may not be met; however, risk calculations are based on ingestion of soil, and this would be unavailable for ingestion. Ground water cleanup action levels would be met. After remediation is completed, all risks are reduced below acceptable levels.	Significantly and permanently reduces mobility of contaminants in soil and mobility, toxicity and volume of contaminants in ground water. Some contaminants in ground water are transferred to salt crystals which are disposed of off site. Does not significantly or permanently reduce toxicity or mobility of these residuals.

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Table 11

TABLE 4-3

MIDCO I

IMPLEMENTABILITY EVALUATION OF ALTERNATIVES

	TECHNICAL FEASIBILITY SHORT TERM	TECHNICAL FEASIBILITY LONG TERM	AVAILABILITY	ADMINISTRATIVE FEASIBILITY
Alternative 1	No remedial action is taken with this alternative; therefore, no construction difficulties will be encountered and no schedules will be delayed. No action-specific requirements are related to this alternative.	It is extremely likely that future remedial action will be required. It should be no more difficult to implement the additional remedial action than at present. Migration or exposure pathways can be readily monitored. Since no operation and maintenance is performed, long-term O&M difficulties are not anticipated.	The no-action option is a readily available technology.	It is extremely unlikely that this alternative would receive the necessary approvals from any agency or from the community. Location and chemical-specific requirements would not be met.
Alternative 2	Short-term technical feasibility of alternative is adequate. Technologies can be constructed as needed for specific site in a reasonable time period and should perform as expected during the remedial action if proper maintenance is performed. Cap construction will comply with action-specific requirements.	It is probable that future remedial action would be required if contaminants move off site with the ground water. Installation of the cap should not preclude possible future remedial actions. The site can be readily monitored and maintained. This alternative would have low implementation, operation and maintenance costs. Long-term maintenance problems may arise from synthetic liner puncture or poor maintenance.	The cap installers should be readily available. These installers would be trained in the operation of the necessary equipment as well as appropriate health and safety precautionary measures.	Construction of the cap must provide long-term minimization of migration of liquids through the cap area. It is unlikely that the community response to this alternative will be favorable, as contaminants may continue to leave the site. While most location-specific requirements may be met, chemical-specific requirements will not. Enforcement of ground water use restrictions may be very difficult.
Alternative 3	Attapulgite clay rather than Wyoming clay may be needed. It is anticipated that an adequate supply of clay can be obtained. It is expected that with proper bench-scale testing and installation, technology will be capable of meeting performance specifications. Action-specific requirements will be met. Excavation will take place outside the area requiring soil remediation. Therefore, construction should not trigger cleanup or land disposal restrictions.	Future remedial action such as ground water extraction and treatment may be required if it is determined that the contaminants are moving through the confining layer beneath the site. While future remedial actions are not precluded by the current action, the construction of a wall and cap could effect the construction of future remedial action. Monitoring of the site for effectiveness should be no problem. Difficulties with long-term O&M may arise from action of the contaminants, especially the salt and organics, on the wall itself.	Containment walls are a demonstrated technology that are readily available and easy to construct. Adequate clay should be available. The necessary equipment and specialists should be available and trained in the necessary health and safety techniques. Lack of commercial deep well facilities may affect alternative. Presently deep well facilities are available.	Acceptance of this alternative would be possible. A condition of the acceptance would include deed and access restrictions, as well as careful monitoring to ensure the waste is not moving through to the next aquifer.
Alternative 4A	It is expected that the biggest difficulty with the option will be in obtaining approval of the Petition Demonstration. This could result in problems with the remedial schedule. It is expected that all action-specific requirements can be achieved.	Assuming that the extraction wells are properly placed to influence the area, the deep well is properly constructed and the Mt. Simon aquifer is an appropriate formation, future remedial action is not anticipated. This option does not preclude future remedial action at the site. While migration or exposure pathways close to the surface may be readily monitored, monitoring of the injection zone to determine whether the material is confined, may prove difficult. Failure to detect problems may result in contamination of another aquifer. No difficulties are foreseen in long-term operation and maintenance.	Extraction well, deep well and cap installers with related equipment should be available.	The need for a Petition Demonstration may delay implementation of this project. In addition, approval for a permit must be obtained. Because the regulations governing underground injection wells are in a state of flux, it is impossible at this time to determine agency response. If an adequate Petition Demonstration can be prepared for USEPA, the alternative should be able to obtain approval from other agencies. Some community response may be received in regard to treatment by injection rather than conventional techniques. Due to the large number of CERCLA sites in the area, other sites may benefit from the implementation of this alternative.

TABLE 1

IMPLEMENTABILITY EVALUATION OF ALTERNATIVES

	TECHNICAL FEASIBILITY SHORT TERM	TECHNICAL FEASIBILITY LONG TERM	AVAILABILITY	ADMINISTRATIVE FEASIBILITY
Alternative 4B	It is expected that all location and action-specific requirements can be achieved. Based on past performance, technologies should be capable of providing process efficiencies to remove F001 to F005 solvents to the required level before deep well injection. Air stripping and granular activated carbon are widely used conventional technologies that should encounter no difficulties during construction.	With adequate operation and maintenance, technologies should continue to provide the necessary process efficiencies. Assuming that the extraction wells are properly placed to influence the area, the deep well is properly constructed and the Mt. Simon aquifer is an appropriate formation, future remedial action is not anticipated. This option does not preclude future remedial action at the site. While migration or exposure pathways close to the surface may be readily monitored, monitoring of the injection zone to determine whether the material is confined, may prove difficult. Failure to detect problems may result in contamination of another aquifer. No difficulties are foreseen in long-term operation and maintenance. Regulations are in a state of flux. Additional restrictions on hazardous compounds may require additional treatment.	Extraction well, deep well, cap and process unit installers with related equipment as well as all process units themselves should be available. Disposal/recycle facilities for the spent carbon are limited to four facilities but should not prevent implementation.	Approval for the deep well must be obtained. Because the regulations governing underground injection wells are in a state of flux, it is impossible at this time to determine agency response. Some community response may be received in regard to treatment by injection rather than conventional techniques. Due to the large number of CERCLA sites in the area, other sites may benefit from the implementation of this alternative. Alternative may be more likely to be approved by agencies, since no Petition Demonstration is necessary.
Alternative 4C	It is expected that all location and action-specific requirements can be achieved. Based on past performance, technologies should be capable of providing process efficiencies to remove contaminants to drinking water quality except salinity. Air stripping, cyanide oxidation, metals precipitation, and carbon adsorption are widely used conventional technologies that should encounter little difficulty during construction.	With adequate operation and maintenance, technologies should continue to provide the necessary process efficiencies. Assuming that the extraction wells are properly placed to influence the area, the deep well is properly constructed and the Mt. Simon aquifer is an appropriate formation, future remedial action is not anticipated. This option does not preclude future remedial action at the site. While migration or exposure pathways close to the surface may be readily monitored, monitoring of the injection zone to determine whether the material is confined, may prove difficult. Failure to detect problems may result in contamination of another aquifer. No difficulties are foreseen in long-term operation and maintenance. Regulations are in a state of flux. Additional restrictions on hazardous compounds may require additional treatment.	Extraction well, deep well, cap and process unit installers with related equipment as well as all process units themselves should be available. Adequate capacity in appropriate landfill should be available for metals sludge. Disposal/recycle facilities for the spent carbon are limited to four facilities but should not prevent implementation.	Approval for the deep well must be obtained. Because the regulations governing underground injection wells are in a state of flux, it is impossible at this time to determine agency response. Some community response may be received in regard to treatment by injection rather than conventional techniques. Due to the large number of CERCLA sites in the area, other sites may benefit from the implementation of this alternative. Alternative may be more likely to be approved by agencies, since no Petition Demonstration is necessary and the water is being treated to ground water quality except salinity.
Alternative 4E	It is expected that all location and action-specific requirements can be achieved. Evaporation/crystallization is capable of providing process efficiencies to remove the liquid portion of the extract, allowing for disposal of the remaining solids. Evaporation by itself may not provide a condensate that is clean enough for discharge or shallow aquifer injection. Disposal of salt crystals may be limited by the amount of free cyanide present and could significantly increase the cost of this alternative. Evaporation is a widely used conventional technology that should encounter little difficulty during construction.	With adequate operation and maintenance, evaporation/crystallization should provide necessary treatment over the long term. No difficulties are foreseen in long-term operation and maintenance. Future remedial action is not anticipated. This option does not preclude future remedial action at the site. Monitoring of the site for effectiveness should be no problem.	Extraction well, cap and process unit installers with related equipment as well as the evaporation/crystallization process units themselves should be available. Landfill capacity is limited, but should be available. Distances to off-site landfill facilities are long.	Evaporation of extracted ground water should result in a favorable response from other agencies.

TABLE 4-3

MIDCO I

IMPLEMENTABILITY EVALUATION OF ALTERNATIVES

	TECHNICAL FEASIBILITY SHORT TERM	TECHNICAL FEASIBILITY LONG TERM	AVAILABILITY	ADMINISTRATIVE FEASIBILITY
Alternative 5A	The difficulties related with excavation concern the control of the material. Adequate health and safety provisions must be implemented.	No likely future remedial action is anticipated. Migration or exposure pathways can be adequately monitored. No additional risk of exposure exists, should monitoring fail, as material has been removed from the site. Source control measures have demonstrated performance. Site operation and maintenance are minimal.	The available hazardous waste landfill capacity for disposal of material is limited. Distances to off-site landfill facilities are long and transport would be expensive.	Alternative may not be approvable since ground water contamination will not be remediated. Enforcement of ground water use restrictions may be very difficult. Due to the problems of transportation, community response may not be favorable.
Alternative 5C	It is expected that there will be little difficulty with construction. Procedure similar to RCRA delisting may delay project schedule.	No likely future remedial actions are anticipated. The solidified ash may present problems with future remedial actions. The continued effectiveness should be easily monitored. Maintenance of site is minimal, involving inspection, mowing, erosion protection, and access restriction.	Adequate vapor extraction and incineration equipment and disposal should be available. Necessary operating personnel should be available.	It is expected that this alternative may not be approved by other agencies and the community since ground water contamination will not be remediated. Enforcement of ground water use restrictions may be very difficult. The construction of an on-site incinerator has been known to cause public opposition. Due to the closeness of residences, the implementability is unknown.
Alternative 5E	If proper treatability tests are conducted, it is expected that there will be no difficulty with construction. However, this type of solidification is considered innovative for this large mix of organic and inorganic wastes. Procedure similar to RCRA delisting may delay project schedule.	No likely future remedial actions are anticipated. The solidified material may present problems with future remedial actions. The continued effectiveness of this remedy should be easily monitored. Maintenance of site is minimal, involving inspection, mowing, erosion protection, and access restriction.	Adequate treatment and disposal services should be available. Necessary equipment and specialists should be available, assuming the material is readily solidified and can conform to procedures similar to RCRA delisting.	It is expected that this alternative may not be approved by other agencies and the community since ground water contamination will not be remediated. Enforcement of ground water use restrictions may be very difficult. Unfavorable response may also relate to limiting use of the property by forming a cemented solid.
Alternative 5G	Difficulties during construction may be encountered due to the high ground water table and type of soil. This alternative has been demonstrated during pilot testing; however, the technology has not been proven on a full scale project. Therefore, the alternative should be considered innovative. No excavation of site material would be necessary, thus reducing the workers' exposure to material. Large amounts of electricity are required to operate this type of system. Air pollution controls must be provided to treat off-gases. Equipment must be custom fabricated and assembled. Personnel must be highly skilled. Effects on areas surrounding the melt are uncertain.	It is not anticipated that future remedial action would be needed. This option would preclude some types of remedial action due to the creation of the solid monolith. Area around the source area should be easily and readily monitored and maintained.	At the present time, the necessary equipment and specialists to perform large-scale in-situ vitrification are not available. This may increase the implementation period to an unacceptable level.	Due to the large number of unknowns associated with this innovative treatment, the likelihood of unfavorable community response is increased. Alternative may not be approvable since ground water contamination will not be remediated. Enforcement of ground water use restrictions may be very difficult.

TABLE 4-3

MIDCO I

IMPLEMENTABILITY EVALUATION OF ALTERNATIVES

	TECHNICAL FEASIBILITY SHORT TERM	TECHNICAL FEASIBILITY LONG TERM	AVAILABILITY	ADMINISTRATIVE FEASIBILITY
Alternative 6	Same as Alternatives 3 and 5C. The difficulty of performing two types of remediation on site at one time could delay the construction schedule.	Same as Alternatives 3 and 5C.	Same as Alternatives 3 and 5C.	Same as Alternatives 3 and 5C. Although ground water contamination will not be remediated to cleanup action levels, all the risks are eliminated by preventing contact with contaminated soil and ground water. Due to high level of protection, response will likely be favorable.
Alternative 7	Same as Alternatives 4A and 5C. The difficulty of performing two types of remediation on site at one time could delay the construction schedule.	Same as Alternatives 4A and 5C.	Same as Alternatives 4A and 5C.	Same as Alternatives 4A and 5C. Ground water contamination will be remediated to cleanup action levels. Due to the high level of protection, response will likely be favorable.
Alternative 8	Same as Alternatives 4C and 5C. The difficulty of performing two types of remediation on site at one time could delay the construction schedule.	Same as Alternatives 4C and 5C.	Same as Alternatives 4C and 5C.	Same as Alternatives 4C and 5C. Ground water contamination will be remediated to cleanup action levels. Due to the high level of protection, response will likely be favorable.
Alternative 9	Same as Alternatives 4E and 5C. The difficulty of performing two types of remediation on site at one time could delay the construction schedule.	Same as Alternatives 4E and 5C.	Same as Alternatives 4E and 5C.	Same as Alternatives 4E and 5C. Ground water contamination will be remediated to cleanup action levels. Due to the high level of protection, response will likely be favorable.

Table 12

TABLE 4-20

MIDCO I

DETAILED ANALYSIS SUMMARY

	EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 1	-- Does not reduce potential public health risk associated with contaminated soils if excavated and exposed, ground water if ingested or air if inhaled. Increased lifetime cancer risk to future on-site residents (4.5×10^{-2}) is unacceptable. Toxicity, mobility, or volume of contaminants in soil and ground water are not permanently or significantly reduced.	-- No remedial action is taken with this alternative. It is extremely likely that future remedial action will be required. It is extremely unlikely that this alternative would receive the necessary approvals from any agency or from the community. Location and chemical-specific requirements would not be met.	Total Capital = 0 Annual O&M = 0 Present Worth = 0
Alternative 2	-- Final protection from exposure to on-site contamination is achieved upon completion of cap construction, approximately 1 year after initiation of construction. Cleanup action levels (CALs) for soil and ground water will not be met as soil remains without treatment and ground water that has migrated off site will not be treated. Continued potential for ground water degradation exists due to lateral ground water migration. Surface water contaminants may be worsened by continual discharge of contaminated ground water. Performance of properly installed multi-layered cap is generally good for first 20 years of service. Without ground water use restrictions, the remaining risk at the site after remediation completion would be 1.82×10^{-2}. With enforcement of ground water use restrictions, all risks would be reduced below acceptable levels. Reduces mobility of contaminants in soil but does not significantly or permanently reduce toxicity or volume or reduce the mobility of contaminants that are already in the ground water.	● Technologies can be constructed as needed for specific site. It is probable that future remedial action would be required if contaminants move off site with the ground water. The cap installers should be readily available. It is unlikely that the community response to this alternative will be favorable, as contaminants may continue to leave the site. While most location-specific requirements may be met, chemical-specific requirements will not. Enforcement of ground water use restrictions may be very difficult.	Total Capital = 1,972,000 Annual O&M = 150,000 Present Worth = 3,366,000
Alternative 3	◆ Safety concern during installation related to excavation activities. Protection against principle threat can be achieved upon completion of construction, approximately 1 to 2 years. Cleanup action levels (CALs) for soil and ground water will not be met because no treatment is provided for them. Eliminates direct contact exposure to contaminants. Contamination may move vertically to next aquifer. This aquifer has very little yield, and is not used for drinking water purposes. High salt and organic concentrations may effect permeability of wall. After remediation is completed, all risks are reduced below acceptable levels. Significantly reduces mobility of contaminants in soil and ground water, but does not reduce toxicity or volume.	◆ It is expected that with proper bench-scale testing and installation, technology will be capable of meeting performance specifications. Action-specific requirements will be met. Difficulties with long-term O&M may arise from action of the contaminants, especially the salt and organics, on the wall itself. Containment walls are a demonstrated technology that are readily available and easy to construct. A condition of the acceptance would include deed and access restrictions, as well as careful monitoring to ensure the waste is not moving through to the next aquifer.	Total Capital = 3,192,000 Annual O&M = 150,000 Present Worth = 4,651,000
Alternative 4A	◆ Remedial action activities may not commence for 1 to 2 years, as a Petition Demonstration for deep well must be approved by EPA. Construction of remedial action should take 2 years. Cleanup action levels (CALs) for soil will not be met as soil remains without treatment. The ground water that has migrated off site will be removed where CALs are exceeded and ground water CALs on site would be met. After remediation is completed, if deed restrictions and site maintenance are performed, all risks are reduced below acceptable levels. Significantly and permanently reduces the mobility of contaminants in the soil but does not reduce toxicity or volume of some contaminants in soil. Significantly and permanently reduces mobility of contaminants in ground water.	● It is expected that the biggest difficulty with the option will be in obtaining approval of the Petition Demonstration. Failure to detect problems may result in contamination of another aquifer. Extraction well, deep well and cap installers with related equipment should be available. Because the regulations governing underground injection wells are in a state of flux, it is impossible at this time to determine agency response. Due to the large number of CERCLA sites in the area, other sites may benefit from the implementation of this alternative.	Total Capital = 3,813,000 Annual O&M = 100,000 Present Worth = 5,530,000

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TABLE 4-20

MIDCO I

DETAILED ANALYSIS SUMMARY

	EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 4B	• Remedial action activities may not commence for at least 1 year, as approval for this option must be obtained. Construction of remedial action should take 2 years. Cleanup action levels (CALs) for soil will not be met as soil remains without treatment. The ground water that has migrated off site will be removed where CALs are exceeded and ground water CALs on site would be met. After remediation is completed, if deed restrictions and site maintenance are performed, all risks are reduced below acceptable levels. Significantly and permanently reduces the mobility of contaminants in the soil but does not reduce toxicity or volume of some contaminants in soil. Significantly and permanently reduces mobility and toxicity of contaminants in ground water but does not reduce volume. Some contaminants in ground water are transferred to carbon canisters which are disposed of off site. Does not significantly or permanently reduce toxicity or mobility of these residuals.	• It is expected that all location and action-specific requirements can be achieved. With adequate operation and maintenance, technologies should continue to provide the necessary process efficiencies. Failure to detect problems may result in contamination of another aquifer. Extraction well, deep well, cap and process unit installers with related equipment as well as all process units themselves should be available. Disposal/recycle facilities for the spent carbon are limited. Because the regulations governing underground injection wells are in a state of flux, it is impossible at this time to determine agency response. Alternative may be more likely to be approved by agencies, since no Petition Demonstration is necessary.	Total Capital = 3,513,000 Annual O&M = 480,000 Present Worth = 7,987,000
Alternative 4C	• Approval for this option should not unduly slow action down as contaminants will be removed to drinking water quality except salinity before injection. Construction of remedial action should take 2 years. Cleanup action levels (CALs) for soil will not be met as soil remains without treatment. The ground water that has migrated off site will be removed where CALs are exceeded and ground water CALs on site would be met. The level of acetone being injected into the deep well will exceed the CAL. No MCL or MCLG presently exists for acetone. After remediation is completed, if deed restrictions and site maintenance are performed, all risks are reduced below acceptable levels. Significantly and permanently reduces the mobility of contaminants in the soil but does not reduce toxicity or volume of some contaminants in soil. Significantly and permanently reduces mobility and toxicity of contaminants in ground water but does not reduce volume. Some contaminants in ground water are transferred to carbon canisters and metals sludges which are disposed of off site. Does not significantly or permanently reduce toxicity or mobility of these residuals.	• It is expected that all location and action-specific requirements can be achieved. With adequate operation and maintenance, technologies should continue to provide the necessary process efficiencies. Failure to detect problems may result in contamination of another aquifer. Extraction well, deep well, cap and process unit installers with related equipment as well as all process units themselves should be available. Adequate capacity in appropriate landfill should be available for metals sludge. Disposal/recycle facilities for the spent carbon are limited. Because the regulations governing underground injection wells are in a state of flux, it is impossible at this time to determine agency response. Alternative may be more likely to be approved by agencies, since no Petition Demonstration is necessary and the water is being treated to ground water quality except salinity.	Total Capital = 3,097,000 Annual O&M = 525,000 Present Worth = 8,793,000
Alternative 4E	• Approval for the evaporator system should be readily obtainable as this is conventional technology. Construction of remedial action should take 1 to 2 years. Cleanup action levels (CALs) for soil will not be met as soil remains without treatment. The ground water that has migrated off site will be removed where CALs are exceeded and ground water CALs on site would be met. After remediation is completed, if deed restrictions and site maintenance are performed, all risks are reduced below acceptable levels. Significantly and permanently reduces the mobility of contaminants in the soil but does not reduce toxicity or volume of some contaminants in soil. Significantly and permanently reduces mobility and toxicity of contaminants in ground water but does not reduce volume. Some contaminants in ground water are transferred to salt crystals which are disposed of off site. Does not significantly or permanently reduce toxicity or mobility of these residuals.	• It is expected that all location and action-specific requirements can be achieved. With adequate operation and maintenance, evaporation/crystallization should provide necessary treatment over the long term. Evaporation by itself may not provide a condensate that is clean enough for discharge or shallow aquifer injection. Extraction well, cap and process unit installers with related equipment as well as the evaporation/crystallization process units themselves should be available. Landfill capacity is limited, but should be available. Distances to off-site landfill facilities are long. Disposal of salt crystals may be limited by the amount of free cyanide present and could significantly increase the cost of the alternative. Evaporation of extracted ground water should result in a favorable response from other agencies.	Total Capital = 2,270,000 Annual O&M = 434,000 Present Worth = 6,525,000

TABLE 4-20

MIDCO I

DETAILED ANALYSIS SUMMARY

	EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 5A	- Safety concerns during the remedial action are related to the excavation of the material. Cleanup action levels for soils above ground water level would be met. CALs for soils below ground water may not be met; however, risk calculations are based on ingestion of soil, and these additional solids would be below the water table and unavailable for ingestion. Attenuation results in a dissipation of contaminants, although it will be many years before ground water cleanup action levels will be attained for all compounds. Without ground water use restrictions, the remaining risk at the site after remediation completion would be 1.02×10^{-2}. With enforcement of ground water use restrictions, all risks would be reduced below acceptable levels. Reduces volume of contaminants in soil by removing it from site but transfers the problem to the landfill site. Does not reduce volume, mobility or toxicity of contaminants in ground water.	-- The difficulties related with excavation concern the control of the material. The available hazardous waste landfill capacity for disposal of material is limited. Distances to off-site landfill facilities are long and transport would be expensive. Alternative may not be approvable since off-site ground water contamination will not be remediated. Enforcement of ground water use restrictions may be very difficult. Due to the problems of transportation, community response may not be favorable.	Total Capital = 8,299,000 Annual O&M = 150,000 Present Worth = 9,694,000
Alternative 5C	- Safety concerns during the remedial action are related to the excavation of the material. Extensive requirements including trial burn plus IDEM backlog could delay the the start of remediation up to 2 years. Completion of the construction should be less than 1 year. The actual soil remediation should be less than 1 year. Cleanup action levels for soils above ground water would be met. CALs for soils below ground water may not be met; however, risk calculations are based on ingestion of soil, and these additional solids would be below the water table and unavailable for ingestion. Attenuation results in a dissipation of contaminants, although it will be many years before ground water cleanup action levels will be attained for all compounds. Without ground water use restrictions, the remaining risk at the site after remediation completion would be 1.02×10^{-2}. With enforcement of ground water use restrictions, all risks would be reduced below acceptable levels. Significantly and permanently reduces toxicity and mobility of contaminants in soil but does not reduce toxicity, mobility, or volume of contaminants in ground water.	- It is expected that this alternative may not be approved by other agencies and the community since ground water contamination will not be remediated. Enforcement of ground water restrictions may be very difficult. The construction of an on-site incinerator has been known to cause public opposition. Due to the closeness of residences, the implementability is unknown. Necessary equipment and disposal services as well as operating personnel should be available. Procedures similar to RCRA delisting may delay project schedule.	Total Capital =12,177,000 Annual O&M = 150,000 Present Worth =13,572,000

TABLE 4-20

MIDCO I

DETAILED ANALYSIS SUMMARY

	EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 5E	- Safety concern during installation associated with excavation and mixing of contaminated material. It will be necessary to perform treatability studies to adequately demonstrate that the solidified waste can conform to procedures similar to RCRA delisting. This may delay initiation of construction. Completion of construction should be 1 year. Cleanup action levels for soils above ground water level would be met. CALs for soils below ground water may not be met; however, risk calculations are based on ingestion of soil, and these additional solids would be below the water table and unavailable for ingestion. Attenuation results in a dissipation of contaminants, although it will be many years before ground water cleanup action levels will be attained for all compounds. Without ground water use restrictions, the remaining risk at the site after remediation completion would be 1.82×10^{-2}. With enforcement of ground water use restrictions, all risks would be reduced below acceptable levels. Significantly and permanently reduces mobility of contaminants in soil, but does not reduce toxicity, mobility or volume of contaminants in ground water.	• This type of solidification is considered innovative for this large mix of organic and inorganic wastes. Procedures similar to RCRA delisting may delay project schedule. Adequate treatment and disposal services should be available. It is expected that this alternative may not be approved by other agencies and the community since off-site ground water contamination will not be remediated. Enforcement of ground water use restrictions may be very difficult. Unfavorable response may also relate to limiting use of the property by forming a cemented solid.	Total Capital = 6,241,000 Annual O&M = 150,000 Present Worth = 7,635,000
Alternative 5G	- Because no excavation of material occurs and all of the materials are treated in a hood, risk is minimized. Completion of construction should be 1 to 2 years. Cleanup action levels for soils above ground water level would be met. CALs for soils below ground water may not be met; however, risk calculations are based on ingestion of soil, and these additional solids would be below the water table and unavailable for ingestion. Attentuation results in a dissipation of contaminants, although it will be many years before ground water cleanup action levels will be attained for all compounds. Technology has not been proven on full scale project. Without ground water use restrictions, the remaining risk at the site after remediation completion would be 4.5×10^{-2}. With enforcement of ground water use restrictions, all risks would be reduced below acceptable levels. Significantly and permanently reduces toxicity, mobility and volume of contaminants in soil, but does not reduce toxicity, mobility, or volume of contaminants in ground water.	-- This alternative has been demonstrated during pilot testing; however, effects on areas surrounding the melt are unknown. The technology has not been proven on a full scale project. At the present time, the necessary equipment and specialists to perform large-scale in-situ vitrification are not available. Due to the large number of unknowns associated with this innovative treatment, the likelihood of unfavorable community response is increased. Alternative may not be approvable since off-site ground water contamination will not be remediated.	Total Capital = 8,856,000 Annual O&M = 150,000 Present Worth =10,249,000
Alternative 6	• It will be necessary to perform treatability studies to demonstrate that the solidified waste can conform to procedures similar to RCRA delisting. This may delay construction initiation. Construction of remedial action would take 1 to 2 years. Combines the long-term effectiveness of Alternatives 3 and 5E. Cleanup action levels for soil above ground water will be met. CALs for soil below ground water may not be met; however, risk calculations are based on ingestion of soil, and this would be unavailable for ingestion. Ground water cleanup action levels would not be met on site. After remediation is completed, all risks are reduced below acceptable levels. Significantly and permanently reduces mobility of contaminants in soil and ground water.	• Same as Alternatives 3 and 5E. The difficulty of performing two types of remediation on site at one time could delay the construction schedule. Although ground water contamination will not be remediated to cleanup action levels, all the risks are eliminated by preventing contact with contaminated soil and ground water. Due to the high level of protection, response will likely be favorable.	Total Capital = 8,725,000 Annual O&M = 155,000 Present Worth =10,161,000

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MIDCO I

DETAILED ANALYSIS SUMMARY

	EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 7	•• Remedial action activities for ground water may not commence for 1 to 2 years as a Petition Demonstration for the deep well must be approved. It will be necessary to perform treatability studies to demonstrate that the solidified waste can conform to procedures similar to RCRA delisting. This may delay construction initiation. Construction of the remedial action would take approximately 2 years. Combines the long-term effectiveness of Alternatives 4A and 5C. Cleanup action levels for soil above ground water will be met. CALs for soil below ground water may not be met; however, risk calculations are based on ingestion of soil, and this would be unavailable for ingestion. Ground water cleanup action levels would be met. After remediation is completed, all risks are reduced below acceptable levels. Permanently and significantly reduces mobility of contaminants in soil and ground water.	• Same as Alternatives 4A and 5C. The difficulty of performing two types of remediation on site at one time could delay the construction schedule. Due to the high level of protection, response will likely be favorable.	Total Capital = 9,011,000 Annual O&M = 108,000 Present Worth =10,720,000
Alternative 8	•• Approval for this option should not unduly slow action down as contaminants will be removed to drinking water quality except salinity before injection. It will be necessary to perform treatability studies to demonstrate that the solidified waste can conform to procedures similar to RCRA delisting. This may delay construction initiation. Construction of remedial action would take 2 years. Combines the long-term effectiveness of Alternatives 4C and 5C. Cleanup action levels for soil above ground water will be met. CALs for soil below ground water may not be met; however, risk calculations are based on ingestion of soil, and this would be unavailable for ingestion. Ground water cleanup action levels would be met. If water leaves deep aquifer, since this is not a drinking water aquifer, the increased salinity should not pose a problem. After remediation is completed, all risks are reduced below acceptable levels. Significantly and permanently reduces mobility of contaminants in soil and mobility and toxicity of contaminants in ground water. Some contaminants in ground water are transferred to carbon canisters and metals sludges which are disposed of off site. Does not significantly or permanently reduce toxicity or mobility of these residuals.	• Same as Alternatives 4C and 5C. The difficulty of performing two types of remediation on site at one time could delay the construction schedule. Due to the high level of protection, response will likely be favorable.	Total Capital = 9,094,000 Annual O&M = 525,000 Present Worth =13,989,000

TABLE 4-20

MIDCO I

DETAILED ANALYSIS SUMMARY

	EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 9	++ Approval for the evaporator system should be readily obtainable as this is conventional technology. It will be necessary to perform treatability studies to demonstrate that the solidified waste can conform to procedures similar to RCRA delisting. This may delay construction initiation. Construction of remedial action should take 1 to 2 years. Combines the long-term effectiveness of Alternatives 4C and 5C. Cleanup action levels for soil above ground water will be met. CALs for soil below ground water may not be met; however, risk calculations are based on ingestion of soil, and this would be unavailable for ingestion. Ground water cleanup action levels would be met. After remediation is completed, all risks are reduced below acceptable levels. Significantly and permanently reduces mobility of contaminants in soil and mobility, toxicity, and volume of contaminants in ground water. Some contaminants in ground water are transferred to salt crystals which are disposed of off site. Does not significantly or permanently reduce toxicity or mobility of these residuals.	+ Same as Alternatives 4C and 5C. The difficulty of performing two types of remediation on site at one time could delay the construction schedule. Due to the high level of protection, response will likely be favorable.	Total Capital = 7,532,000 Annual O&M = 454,000 Present Worth =11,700,000

Ratings:
- ++ = Extremely positive
- + = Positive or moderately positive
- 0 = Very little effect or no change from existing condition
- - = Negative effect of moderate significance
- -- = Extremely negative

TABLE 13

MIDCO I

ESTIMATED COSTS IN MILLIONS OF DOLLARS AND TIME TO IMPLEMENT

ALTERNATIVE	PRESENT WORTH	CAPITAL COST	ANNUAL O&M COST	YEARS TO DESIGN AND CONSTRUCT	YEARS TO COMPLETE ACTION
1. No Action	0	0	0	0	0
2. Cap	3.4	2.0	0.15	2	1
3. Containment	4.7	3.2	0.16	3	2
REMEDIES THAT DIRECTLY ADDRESS GROUNDWATER					
4A. Deep Well	5.8	4.0	0.19	4	30
4C. Treat and Deep Well	8.9	4.0	0.53	3	30
4E. Evaporation	6.4	2.1	0.45	3	30
REMEDIES THAT DIRECTLY ADDRESS SOURCE					
5A. Landfill[1]	9.7	8.2	0.15	2	2
5C. Incineration[1]	13.6	12.2	0.15	4	4
5E. Solidification[1]	7.6	6.2	0.15	2	2
5G. Vitrification	10.5	9.1	0.15	3	3
REMEDIES THAT DIRECTLY ADDRESS SOURCE AND GROUNDWATER					
6. Combines 5E[1] with 3	10.0	8.6	0.16	3	3
7. Combines 5E[1] with 4A	10.6	8.9	0.19	4	30
8. Combines 5E[1] with 4C	13.7	8.9	0.53	4	30
9. Combines 5E[1] with 4E	11.4	7.1	0.45	4	30

[1] Excavation for these alternatives is preceded by in-situ vapor extraction.

TABLE 14

MIDCO I

TABLE OF EFFECTIVENESS AND IMPLEMENTABILITY

Alternative	Will Contaninants Migrate Off-site in Ground Water?	Will Action Result in Non-compliance with State or Federal Standards?	Will Contaminants of Potential Health Concern Remain in the Soil or Ground Water?	Will a Significant Amount of Off-site Hazardous Waste Disposal Occur?	Are Significant Implementation Problems Expected?
1. No Action	Yes	Yes	Yes	No	Yes[5]
2. Cap	Yes	Yes	Yes	No	Yes[5] [8]
3. Containment	No	No	Yes	No	No[6]
REMEDIES THAT DIRECTLY ADDRESS GROUNDWATER					
4A. Deep Well	No	No	Yes	No[1]	No[7]
4C. Treat and Deep Well	No	No	Yes	No[2]	No
4E. Evaporation	No	No	Yes	Yes[3]	No
REMEDIES THAT DIRECTLY ADDRESS SOURCE					
5A. Landfill*	Yes	Yes	Yes	Yes	Yes[8]
5C. Incineration*	Yes	Yes	Yes	No[4]	Yes[8]
5E. Solidification*	Yes	Yes	Yes	No[4]	Yes[8]
5G. Vitrification	Yes	Yes	Yes	No	Yes[8] [9]

REMEDIES THAT DIRECTLY ADDRESS SOURCE AND GROUNDWATER

6. (5E + 3)*	No	No	Yes	No[4]	No
7. (5E + 4A)*	No	No	No	No[1] 4	No[7]
8. (5E + 4C)*	No	No	No	No[4] 2	No
9. (5E + 4E)*	No	No	No	Yes[3] 4	No

*Excavation for these alternatives is preceded by in-situ vapor extraction.

[1] Hazardous Waste Disposal in Deep Aquifer.

[2] Small amounts of precipitated metals and spent carbon may be landfilled.

[3] Salt cake contaminated with metals, cyanide and some organics will be landfilled. Organic liquids will be incinerated.

[4] Small amounts of liquids from in-situ vapor extraction will be incinerated.

[5] Approval under CERCLA is unlikely.

[6] The long term effectiveness of the slurry wall is uncertain.

[7] May be problems obtaining approval for deep well injection.

[8] Ground water usage restrictions difficult to implonent.

[9] Procedures are not proven in a full scale project. High water table may cause difficulties during contruction.

Table 15

TABLE 4-15

ALTERNATIVE 7
GROUND WATER PUMPING AND DEEP WELL INJECTION WITH IN-SITU VAPOR EXTRACTION AND SOLIDIFICATION ABOVE GROUND WATER ELEVATION
COST ESTIMATE

Site/Process Preparation	$ 6,970
Soil/Sediment Handling/Treatment	3,227,000
Ground Water Handling/Treatment	1,687,400
Site Restoration	101,250
Access Restriction	24,590
Monitoring System	149,600
CONSTRUCTION SUBTOTAL	$ 5,196,810
Contingencies	2,078,724
CONSTRUCTION TOTAL	$ 7,275,534
Permitting	135,000
Services During Construction	725,000
Delisting	150,000
Engineering	725,000
TOTAL CAPITAL COST	$ 9,011,000
ANNUAL OPERATION AND MAINTENANCE	$ 188,000
TOTAL PRESENT WORTH (10% discount rate, 30-year life)	$10,728,000

See Appendix D for detailed cost information

Table 16

TABLE 4-16

ALTERNATIVE 8
GROUND WATER PUMPING, GROUND WATER TREATMENT TO DRINKING WATER QUALITY EXCEPT SALINITY, AND DEEP WELL INJECTION WITH IN-SITU VAPOR EXTRACTION AND SOLIDIFICATION ABOVE GROUND WATER ELEVATION *
COST ESTIMATE

Site/Process Preparation	$ 6,970
Soil/Sediment Handling/Treatment	3,227,000
Ground Water Handling	1,187,400
Ground Water Treatment	474,000
Site Restoration	101,250
Access Restriction	24,590
Monitoring System	149,600
CONSTRUCTION SUBTOTAL	$ 5,170,810
Contingencies	2,068,324
CONSTRUCTION TOTAL	$ 7,239,134
Permitting	155,000
Services During Construction	775,000
Delisting	150,000
Engineering	775,000
TOTAL CAPITAL COST	$ 9,094,000
ANNUAL OPERATION AND MAINTENANCE	$ 525,000
TOTAL PRESENT WORTH (10% discount rate, 30-year life)	$13,989,000

See Appendix D for detailed cost information

* Costs are estimated to be $800,000 less for treatment only to meet Land Disposal Restriction Treatment standards.

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Table 17

TABLE 1-6 (PAGE 1 OF 2)

MIDCO I
GROUND WATER CLEANUP ACTION LEVELS

Compound	Detection Limit[a] (µg/1)	Cleanup Action Level (µg/1)	Basis
Arsenic	10	6	Ground water background concentration (95% UCL).
Barium	200	118	Ground water background concentration (95% UCL).
Cadmium	5	0.235	Noncarcinogenic risk from the site (all media) <1.
Chromium	10	8	Ground water background concentration (95% UCL).
Copper		50	Chronic Water Quality Criteria for the protection of freshwater life, with a dilution factor of 3.85 (from Midco I Remedial Investigation Report), lowest detected hardness.
Iron		3,880	Ground water background concentration (95% UCL).
Lead		13.5	Chronic Water Quality Criteria for the protection of freshwater life, with a dilution factor of 3.85, lowest detected hardness.
Manganese		1,400	Ground water background concentration (95% UCL).
Mercury	0.2	0.0462	Chronic Water Quality Criteria for the protection of freshwater life, with a dilution factor of 3.85
Nickel		58	Ground water background concentration (95% UCL).
Selenium	5	1.41	Noncarcinogenic risk from the site (all media) <1.
Silver	10	0.462	Chronic Water Quality Criteria for the protection of freshwater life, with a dilution factor of 3.85.
Vanadium	50	4.33	Ground water background concentration (95% UCL).
Zinc	20	7.33	Noncarcinogenic risk from the site (all media) <1.
Cyanide		10.4	Ground water background concentration (95% UCL).
Vinyl chloride	1.8	1.32	Ground water background concentration (95% UCL).
Chloroethane		10	Ground water background detection limit.
Methylene chloride	5	1.3	Ground water beclground concentration (95%)UCL).
Acetone		11.1	Noncarcinogenic risk from the site (all media) <1.
Carbon disulfide	5	0.253	Noncarcinogenic risk from the site (all media) <1.
1,1-Dichloroethene	1.3	0.000165	Carcinogenic risk from the site (all media) <1 E-06.
1,1-Dichloroethane	0.7	0.00808	Carcinogenic risk from the site (all media) <1 E-06.
Trans-1,2-dichloroethene		70	Maximum Contaminant Level Goal (proposed).
Chloroform	0.5	0.00275	Carcinogenic risk from the site (all media) <1 E-06.
1,2-Dichloroethane	0.3	0.00191	Carcinogenic risk from the site (all media) <1 E-06.
2-Butanone	10	8.44	Noncarcinogenic risk from the site (all media) <1.
1,1,1-Trichloroethane		21.5	Noncarcinogenic risk from the site (all media) <1.
Trichloroethene	1.2	0.0139	Carcinogenic risk from the site (all media) <1 E-06.
Benzene	2	0.00601	Carcinogenic risk from the site (all media) <1 E-06.
2-Hexanone		10	Ground water background detection limit.

TABLE 1-6 (PAGE 2 OF 2)

Compound	Detection Limit* (µg/l)	Cleanup Action Level (µg/l)	Basis
4-Methyl-2-Pentanone	10	2.6	Noncarcinogenic risk from the site (all media) <1.
Tetrachloroethene	0.3	0.0119	Carcinogenic risk from the site (all media) <1 E-06.
Toluene		71.8	Noncarcinogenic risk from the site (all media) <1.
Ethylbenzene		11.1	Noncarcinogenic risk from the site (all media) <1.
Xylenes		55	Noncarcinogenic risk from the site (all media) <1.
Phenol		4.46	Noncarcinogenic risk from the site (all media) <1.
Bis(2-chloroethyl)ether	10	0.000158	Carcinogenic risk from the site (all media) <1 E-06.
Benzyl alcohol		10	Ground water background detection limit.
Cresol	10	5.57	Noncarcinogenic risk from the site (all media) <1.
Nitrobenzene	10	0.0639	Noncarcinogenic risk from the site (all media) <1.
Isophorone	10	0.179	Carcinogenic risk from the site (all media) <1 E-06.
2,4-Dimethylphenol		10	Ground water background detection limit.
Benzoic Acid		446	Noncarcinogenic risk from the sote (all media) <1.
2,4-Dichlorophenol	3.9	0.133	Noncarcinogenic risk from the site (all media) <1.
Naphthalene	10	2.36	Noncarcinogenic risk from the site (all media) <1.
N-Nitrosodiphenylamine	10	0.26	Ground water background concentration (95% UCL).
Pentachlorophenol	36	2.19	Noncarcinogenic risk from the site (all media) <1.
Bis(2-ethylhexyl)phthalate	10	1.5	Ground water background concentration (95% UCL).
Lindane	0.04	0.000565	Carcinogenic risk from the site (all media) <1 E-06.
Dieldrin	0.02	0.0000109	Carcinogenic risk from the site (all media) <1 E-06.
Endrin	0.06	0.00886	Chronic Water Quality Criteria for the protection of freshwater life, with a dilution factor of 3.85.

*Practical quantitation limits as per USEPA "Test Methods for Evaluating Solid Waste," 3rd Edition, SW-846, Nov. 1986. Values shown are higher than the corresponding cleanup action levels. Therefore, the actual cleanup action level for each of these compounds is "nondetectable."

UCL: Upper confidence limit of the average concentration (from Midco I Remedial Investigation).

Table 18

TABLE 1-7 (PAGE 1 OF 2)

MIDCO I
SOIL CLEANUP ACTION LEVELS

Compound	Detection Limit* (µg/kg)	Cleanup Action Level (µg/kg)	Basis
Antimony		2,940	Noncarcinogenic risk from the site (all media) <1.
Arsenic		14,000	Surface soil background average concentration.
Barium		233,000	Noncarcinogenic risk from the site (all media) <1.
Beryllium		310	Noncarcinogenic risk from the site (all media) <1.
Cadmium		2,770	Surface soil background average concentrtation.
Chromium		36,800	Noncarcinogenic risk from the site (all media) <1.
Copper		48,900	Surface soil background concentration (95% UCL).
Iron		13,700,000	Surface soil background concentration (95% UCL).
Lead		146,000	Surface soil background concentration (95% UCL).
Manganese		133,000	Noncarcinogenic risk from the site (all media) <1.
Mercury		305	Noncarcinogenic risk from the site (all media) <1.
Nickel		47,000	Noncarcinogenic risk from the site (all media) <1.
Tin		6,990	Noncarcinogenic risk from the site (all media) <1.
Vanadium		22,900	Noncarcinogenic risk from the site (all media) <1.
Zinc		1,010,000	Noncarcinogenic risk from the site (all media) <1.
Cyanide		47,000	Noncarcinogenic risk from the site (all media) <1.
Methylene Chloride		2,270	Carcinogenic risk from the site (all media) <1 E-06.
Acetone		47,500	Noncarcinogenic risk from the site (all media) <1.
Trans-1,2-Dichloroethene		5	Surface soil background detection limit.
2-Butanone		97,200	Noncarcinogenic risk from the site (all media) <1.
1,1,1-Trichloroethane		17,900	Noncarcinogenic risk from the site (all media) <1.
Trichloroethene		1,550	Carcinogenic risk from the site (all media) <1 E-06.
Benzene		587	Carcinogenic risk from the site (all media) <1 E-06.
2-Hexanone		10	Surface soil background detection limit.
4-Methyl-2-pentanone		70,300	Noncarcinogenic risk from the site (all media) <1.
Tetrachloroethene		334	Carcinogenic risk from the site (all media) <1 E-06.
Toluene		975,000	Noncarcinogenic risk from the site (all media) <1.
Chlorobenzne		32,000	Noncarcinogenic risk from the site (all media) <1.
Ethylbenzene		289,000	Noncarcinogenic risk from the site (all media) <1.
Styrene		5	Surface soil background detection limit.
Xylenes		714,000	Noncarcinogenic risk from the site (all media) <1.
Phenol		94,000	Noncarcinogenic risk from the site (all media) <1.
1,4-Dichlorobenzene		14.5	Carcinogenic risk from the site (all media) <1 E-06.
Cresol		991	Noncarcinogenic risk from the site (all media) <1.
N-Nitrosodipropylamine		330	Surface soil background detection limit.

TABLE 1-7 (PAGE 2 OF 2)

Compound	Detection Limit* (µg/kg)	Cleanup Action Level (µg/kg)	Basis
Isophorone		4,150	Carcinogenic risk from the site (all media) <1 E-06.
2,4-Dimethylphenol		330	Surface soil background detection limit.
Benzoic acid	1,600	1,220	Noncarcinogenic risk from the site (all media) <1.
Naphthalene		44,800	Noncarcinogenic risk from the site (all media) <1.
4-Chloro-3-Methylphenol	240	4.7	Noncarcinogenic risk from the site (all media) <1.
2-Methylnaphthalene		330	Surface soil background detection limit.
Acenaphthene		330	Surface soil background detection limit.
Dibenzofuran		330	Surface soil background detection limit.
Diethylphthalate	330	60	Noncarcinogenic risk from the site (all media) <1.
Fluorene		330	Surface soil background detection limit.
Pentachlorophenol		4,240	Noncarcinogenic risk from the site (all media) <1.
Phenanthrene	330	131	Surface soil background concentration (95% UCL).
Anthracene		330	Surface soil background detection limit.
Di-n-butylphthalate		26,300	Noncarcinogenic risk from the site (all media) <1.
Fluoranthene		255	Surface soil background concentration (95% UCL).
Pyrene		249	Surface soil background concentration (95% UCL).
Butylbenzylphthalate		26,800	Noncarcinogenic risk from the site (all media) <1.
Benzo(a)anthracene		158	Surface soil background concentration (95% UCL).
Bis(2-ethylhexyl)phthalate		1,220	Carcinogenic risk from the site (all media) <1 E-06.
Chrysene		238	Surface soil background concentration (95% UCL).
Di-n-octylphthalate	330	36.4	Surface soil background concentration (95% UCL).
Benzo(b)fluoranthene		241	Surface soil background concentration (95% UCL).
Benzo(k)fluoranthene		154	Surface soil background concentration (95% UCL).
Benzo(a)pyrene		137	Surface soil background concentration (95% UCL).
Indeno(1,2,3-cd)pyrene		103	Surface soil background concentration (95% UCL).
Dibenz(a,h)anthracene		330	Surface soil background detection limit.
Benzo(g,h,i)perylene		108	Surface soil background concentration (95% UCL).
Aldrin	2.7	1.0	Carcinogenic risk from the site (all media) <1 E-06.
Dieldrin	1.3	1.06	Carcinogenic risk from the site (all media) <1 E-06.
Endrin		375	Noncarcinogenic risk from the site (all media) <1.
Chlordane		4,100	Surface soil background concentration (95% UCL).
PCBs	80	2.21	Carcinogenic risk from the site (all media) <1 E-06.

*Practical quantitation limits as per USEPA "Test Methods for Evaluating Solid Waste," 3rd Edition, SW-846, Nov. 1986. Values shown are higher than the corresponding cleanup action levels. Therefore, the actual cleanup action level for each of these compounds is "nondetectable."

UCL: Upper confidence limit of the average concentration (from Table 13).

TABLE 19

LAND DISPOSAL RESTRICTION TREATMENT STANDARDS FOR WASTE CATEGORIES F001, F002, F003, F005 (FROM 40 CFR 268.41)

CONSTITUENT	CONCENTRATIONS IN EXTRACT mg/l	
	Wastewaters	Non-wastewaters*
acetone	0.05	0.59
n-butyl alcohol	5.0	5.0
carbon disulfide	1.05	4.81
carbon tetrachloride	0.15	0.96
chlorobenzene	0.15	0.05
cyclohexanone	0.125	0.75
1,2 dichlorobenzene	0.65	0.125
ethyl acetate	0.05	0.75
ethyl benzene	0.05	0.053
ethyl ether	0.05	0.75
isobutanol	5.0	5.0
methanol	0.25	0.75
methylene chloride	0.20	0.96
methyl ethyl ketone	0.05	0.75
methyl isobutyl ketone	0.05	0.33
pyridine	1.12	0.33
tetrachloroethylene	0.079	0.05
toluene	1.12	0.33
1,1,1-trichloroethane	1.05	0.41
1,1,2-trichloro-1,2,2 trifluoroethane	1.05	0.96
trichloroethylene	0.065	0.091
trichloroflouromethane	0.05	0.96
xylene	0.05	0.15

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*A capacity variance is in effect for soil waste and debris until November 1990.

TABLE 20

PROPOSED LAND RESTRICTION TREATMENT STANDARDS FOR WASTE CATEGORIES F007, F008, F009, (FROM F.R., VOL, 53, NO. 7, P. 1068)

WASTEWATERS:

CONSTITUENT	TOTAL COMPOSITION (mg/l)	TCLP (mg/l)
cyanide (total)	12	
cyanide (amenable)	1.3	
chromium	0.32	
lead	0.04	
nickel	0.44	

NONWASTEWATERS:

	(mg/kg)	(mg/l)
cyanides (total)	110	
cyanides (amenable)	0.064	
cadium		0.066
chromium		5.2
lead		0.51
nickel		0.32
silver		0.072

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TABLE 21

structural/functional groups shown in column 1 of Highlight 5. After dividing the BDAT constituents into their respective structural/functional groups, the next step is to compare the concentration of each constituent with the threshold concentration (see column 3 of Highlight 5) and to select the appropriate concentration level or percent reduction range. If the concentration of the restricted constituent is less than the threshold concentration, the waste should be treated to within the concentration range. If the waste concentration is above the threshold, the waste should be treated to reduce the concentration of the waste to within the specified percent reduction range. Once the appropriate treatment range is selected, the third step is to identify and select a specific technology that can achieve the necessary concentration or percent reduction. Column 5 of Highlight 5 lists technologies that (based on existing performance data) can attain the alternative Tre[illegible] Variance levels.

During the implementation of the selected treatment technology, periodic analysis using the appropriate testing procedure (i.e., total waste analysis for organics and TCLP for inorganics) will be required to ensure that the alternate treatment levels for the BDAT constituents requiring control are being attained and thus can be land disposed without further treatment.

Because of the variable and uncertain characteristics associated with unexcavated wastes, from which only sampling data are available, treatment systems generally

Highlight 5. ALTERNATE TREATABILITY VARIANCE LEVELS AND TECHNOLOGIES FOR STRUCTURAL/FUNCTIONAL GROUPS

Structural Functional Groups	Concentration Range (ppm)	Threshold Concentration (ppm)	Percent Reduction Range	Technologies that achieved recommended effluent concentration guidance**
[illegible]				
Halogenated Non-Polar Aromatics	0.5 - 10	100	90 - 99.9	Biological Treatment, Low Temp. Stripping, Soil Washing, Thermal Destruction
Dioxins	0.00001 - 0.05	0.5	90 - 99.9	Dechlorination, Soil Washing, Thermal Destruction
PCBs	0.1 - 10	100	90 - 99.9	Biological Treatment, Dechlorination, Soil Washing, Thermal Destruction
Herbicides	0.002 - 0.02	0.2	90 - 99.9	Thermal Destruction
Halogenated Phenols	0.5 - 40	400	90 - 99	Biological Treatment, Low Temp. Stripping, Soil Washing, Thermal Destruction
Halogenated Aliphatics	0.5 - 2	40	95 - 99.9	Biological Treatment, Low Temp. Stripping, Soil Washing, Thermal Destruction
Halogenated Cyclics	0.5 - 20	200	90 - 99.9	Thermal Destruction
Nitrated Aromatics	2.5 - 10.0	10,000	99 - 99.99	Biological Treatment, Soil Washing, Thermal Destruction
Heterocyclics	0.5 - 20	200	90 - 99.9	Biological Treatment, Low Temp. Stripping, Soil Washing, Thermal Destruction
Polynuclear Aromatics	0.5 - 20	400	95 - 99.9	Biological Treatment, Low Temp. Stripping, Soil Washing, Thermal Destruction
Other Polar [illegible] Organics phenol	0.5 - 10	100	90 - 99.9	Biological Treatment, Low Temp. Stripping, Soil Washing, Thermal Destruction
INORG[illegible]				
Antimony	0.1 - 0.2	2	90 - 99	Immobilization
Arsenic	[illegible] - 1	10	90 - 99.9	Immobilization, Soil Washing
Barium	0.1 - 40	400	90 - 99	Immobilization
Chromium	0.5 - 6	120	95 - 99.9	Immobilization, Soil Washing
Nickel	0.5 - 1	20	95 - 99.9	Immobilization, Soil Washing
Selenium	0.005	0.05	90 - 99	Immobilization
Vanadium	0.2 - 22	200	90 - 99	Immobilization
Cadmium	0.2 - 2	40	95 - 99.9	Immobilization, Soil Washing
Lead	0.1 - 3	300	99 - 99.9	Immobilization, Soil Washing
Mercury	0.0002 - 0.008	0.06	90 - 99	Immobilization

* *TCLP also may be used when evaluating waste with relatively low levels of organics that have been treated through an immobilization process.*

** *Other technologies may be used if treatability studies or other information indicates that they can achieve the necessary concentration or percent-reduction range.*

MIDCO I AND MIDCO II RESPONSIVENESS SUMMARY

I. RESPONSIVENESS SUMMARY OVERVIEW

In accordance with CERCLA Section 117, a public comment period was held from April 20, 1989 to May 19, 1989, to allow interested parties to comment on the United States Environmental Protection Agency's (U.S. EPA's) Feasibility Studies (FSs) and Proposed Plans for final remedial actions at the Midco I and Midco II hazardous waste sites. On April 27, U.S. EPA conducted a public meeting in which the Proposed Plans were presented, questions answered and public comments accepted.

The purpose of this responsiveness summary is to document comments received during the public comment period, and provide U.S. EPA's responses to these comments. All comments summarized in this document were considered in EPA's final decision for remedial action at the Midco I and Midco II sites.

II. BACKGROUND ON COMMUNITY INVOLVEMENT

The Midco I site (as well as another National Priorities List site, Ninth Avenue Dump) is located in Gary, Indiana. The nearest residential area is in Hammond, Indiana within one-fourth mile of the site. On December 21, 1976, a fire at Midco I destroyed thousands of drums of chemicals. Community concern about the site intensified in 1981. In March 1981, a 14-year old Hammond boy suffered leg burns while playing near the site; his parents attributed the burns to chemicals. In June 1981, a heavy rainfall resulted in flooding in Hammond and the flow of surface water from the Midco I and Ninth Avenue Dump areas into Hammond. Several residents complained of chemical odors in flooded basements and chemical burns from contact with flood waters. These problems were attributed to run-off from Midco I and Ninth Avenue Dump. In response to this occurrence, Hammond constructed a dirt dike across Ninth Avenue at the Cline Avenue overpass. This dike is still in place and is a source of controversy between Gary and Hammond public officials. The Indiana Department of Environmental Management sent a letter stating that the dike was still necessary to prevent contamination from the sites from entering Hammond. Gary and Hammond public officials and nearby Hammond residents have been actively involved in promoting remedial actions at Midco I.

The Midco II site is more isolated from residential areas. The nearest residences are a small cluster of homes located approximately one mile southeast of the site. In 1977, a fire occurred at the site that destroyed thousands of drums of chemical wastes.

In 1981, U.S. EPA installed fences around Midco I and Midco II. In 1982, U.S. EPA conducted a surface removal action at Midco I that included removal of all containerized wastes and the top one foot of contaminated soil, and installation of a temporary clay cover. From 1984-1989, U.S. EPA conducted a removal action at Midco II that included the removal of all containerized wastes, and excavation and removal of contaminated sub-surface soils in areas where wastes had been dumped directly onto the ground. On July 8, 1982, a public meeting was held to discuss the Midco I removal action. Other community relations activities were also conducted during the removal actions.

U.S. EPA held public meetings to discuss the initiation of the Remedial Investigation/Feasibility Studies (RI/FSs) on February 21, 1985 for Midco I and on July 18, 1985 for Midco II. Residential well sampling for the RI/FSs identified several contaminated wells, but the contamination was not attributable to the Midco sites. U.S. EPA provided updates to the community on the status of the studies using fact sheets in November 1987 and December 1988.

Proposed Plans for Midco I and Midco II were combined into one fact sheet and mailed to over 100 concerned parties. Oral comments were accepted during the public meeting on April 27, 1989. In addition, written comments were received during the public comment period from the City of Hammond, the Indiana Department of Highways, a private citizen in Gary, a slurry wall contractor, the Midco Steering Committee (which represents the potentially responsible parties that conducted the RI/FSs), and from Morton-Thiokol, Inc.

III. SUMMARY OF SIGNIFICANT COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND U.S. EPA RESPONSES

The comments are organized into the following categories:

A. Comments received during the public meeting, and comments received in writing from the City of Hammond, from a slurry wall contractor and from a private citizen from Gary.

B. Comments received from the Indiana Department of Highways.

C. Comments received from the Midco Steering Committee and from Morton-Thiokol.

A. SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC MEETING, AND COMMENTS RECEIVED IN WRITING FROM THE CITY OF HAMMOND, FROM A SLURRY WALL CONTRACTOR AND FROM A PRIVATE CITIZEN FROM GARY

COMMENT #1:

A number of comments were received concerning the protectiveness of deep well injection of hazardous wastes. The specific comments included the following:

> "In 13 states casings have cracked and leaked in deep well injections."
>
> "Why is it they never address with landfills or deep well injections earthquakes in the area and what they anticipate is going to happen to all these nice little hazardous waste dumps we have either under the ground or on top or wherever they're at."
>
> "I would like to know how many deep wells there are in existence today."

"How long have they been in existence?"

"Have there been any problems with any of them?"

"How does the EPA prevent any problems? Are you saying that because they stepped in there are no more problems or what?"

"Isn't it true that the steel mills stopped disposing of their own waste by deep well injection many years ago? What are they injecting now?"

"I am requesting that ... (2) the E.P.A. report how the preferred option of injecting hazardous wastes two thousand (2,000) feet underground will affect my neighbors' well as my own."

"There is always the possibility that the substance injected into the deep well will contaminate other aquifers."

"In addition, although these aquifers may not currently be used because of their depth, or because they contain salt-water there may come a time when out of necessity they may be needed to supply drinking water to future generations."

"At a minimum the contamination in the ground water should be treated prior to any deep well injections so as to mitigate any adverse environmental effects that may occur in the future."

"The solution to environmental problems is not to place out of sight or to dilute, but to correct."

U.S. EPA RESPONSE TO COMMENT #1:

Congress recognized concerns regarding deep well injection of hazardous wastes and enacted a number of statues to assure that deep well injection is only conducted at locations and using procedures that will assure long-term protection of human health and the environment. Deep well injection is regulated by U.S. EPA under a number of statutes, primarily the Safe Drinking Water Act (SDWA) (Pub. L. 93-523, as amended; 42 U.S.C. 300f et seq.), and the Resource Conservation and Recovery Act (RCRA) (Pub. L. 94-580 as amended; 42 U.S.C., 6901 et. seq.). RCRA was modified by the Hazardous and Solid Waste Amendments (HSWA) of 1984 to restrict land disposal and deep well injection of hazardous wastes. Congress intended that deep well injection be allowed only if it is protective of both current sources of drinking water, and any ground water that could potentially serve as an underground source of drinking water (USDW). A USDW generally includes any aquifer that contains a sufficient quantity of ground water to supply a public water system and contains less than 10,000 mg/l of total dissolved solids (TDS). Recovery of drinking water from an aquifer with a TDS greater than 10,000 mg/l is not considered to be technically or economically feasible. (See 40 CFR 144.3).

Regulations under the SDWA prohibit (with few exceptions) injection of any hazardous waste into a USDW. Hazardous wastes can only be injected into formations that are below the lower-most formation containing, within one-quarter mile of the well bore, a USDW. All injection wells must be permitted by U.S. EPA or an appropriate state agency. Regulations regarding permit requirements have undergone extensive review and public comment. Permit conditions prohibit any injection activity that allows the movement into a USDW of fluid containing any contaminant, if the presence of that contaminant may cause a violation of any primary drinking water regulation (40 CFR 144.12) or may otherwise adversely affect the health of persons. Another permit condition requires permittees to take all reasonable steps to minimize or correct any adverse impact on the environment resulting from non-compliance with the permit. (See 40 CFR 144.12).

Underground injection permits include strict construction, corrective action, operation, abandonment, monitoring, reporting and financial requirements to assure that the injection well is constructed and operated in a manner that will meet U.S. EPA requirements and be protective of human health and the environment.

U.S. EPA's permit review assures that hazardous waste injection wells are only constructed in locations that are geologically suitable. This includes consideration of the following factors:

1) the structural geology, stratigraphic geology, the hydrogeology, and the seismicity of the region (including evaluation of the potential for earthquakes);

2) an analysis of the local geology and hydrogeology of the well site;

3) a determination that the geology of the area can be confidently described and that the limits of waste fate and transport can be accurately predicted through the use of models.

Hazardous waste injection wells must be sited such that:

1) the injection zone has sufficient permeability, porosity, thickness and areal extent to prevent migration of fluids into a USDW;

2) a confining zone is present above the injection zone which is laterally continuous and free of transecting, transmissive faults or fractures over an area sufficient to prevent the movement of fluids into a USDW, and which contains at least one formation of sufficient thickness and with lithologic and stress characteristics capable of preventing vertical propagation of fracture.

In addition, U.S. EPA may require that the owner or operator of a hazardous waste deep well demonstrate either:

1) that the confining zone is separated from the base of the lowermost USDW by at least one sequence of permeable and less permeable strata that will provide an added layer of protection for the USDW in the event of fluid movement in an unlocated borehole or transmissive fault; or

2) that within the area of review, the piezometric surface of the fluid in the injection zone is less than the piezometric surface of the lowermost USDW; or

3) that there is no USDW present.

(See 40 CFR 146.62).

Further data collection is required during construction of the deep well to determine or verify the geology and the quality of the construction. Measurements include resistivity, spontaneous potential, caliper, cement bond, density, temperature, porosity, gamma ray and fracture finder logs, a pressure test, a radioactive tracer survey, core samples, and a casing inspection survey. The injection well must be cased and sealed to prevent any migration of injection fluid up the borehole. A double casing is required from the surface to below the lowermost USDW.

The owner or operator must assure that the injection pressure at the wellhead does not exceed a maximum pressure in the injection zone during injection, and does not initiate new fractures or propagate existing fractures in the injection zone. The injection tubing must be surrounded by an annular space, which is filled with fluid. The injection pressure, flow rate, and volume of injected fluids, and the pressure on the annulus, must be continuously monitored.

U.S. EPA uses three interrelated program requirements to assure compliance with well operating regulations. Mechanical integrity tests measure the operating soundness of the wells, including checking for leaks. Operator reports include information on the waste being injected; the well pressure, flow rate and volume; and report the degree of permittee compliance with these permit conditions. Periodic inspections determine the accuracy of operator self-monitoring and the adequacy of injected-waste sampling. The attached "A GUIDE TO THE FEDERAL UNDERGROUND INJECTION CONTROL PROGRAM IN INDIANA" provides a general description of the permit program and how potential pathways of contamination are controlled in the deep wells.

Congress addressed concerns about the long term protectiveness of landfilling or underground injection of hazardous wastes in the HSWA. This act established land (or deep well) disposal restrictions focused on minimization of land disposal or deep well injection of hazardous wastes. These restrictions prohibit the land disposal or deep well injection of specified hazardous wastes beyond statutory dates established by Congress unless 1) the wastes are treated to a level or method specified by U.S. EPA, 2) it can be demonstrated there will be no migration of hazardous constituents from the disposal unit for as long as the waste remains hazardous, or 3) the waste is subject to an exemption or a variance. The no-migration demonstration mentioned above can be approved by U.S. EPA under the condition that the hydrogeological and geochemical conditions at the sites and the physiochemical nature of the waste stream are such that reliable predictions can be made that:

1) injected fluids will not migrate within 10,000 years vertically upward out of the injection zone, or laterally within the injection zone to a point of discharge or interface with a USDW; or

2) before the injected fluids migrate out of the injection zone or to a point of discharge or interface with USDW, the fluid will no longer be hazardous. (See 40 CFR 148.20)

Such a no-migration demonstration must depend heavily on fluid flow modeling. Fluid flow modeling is a well-developed and mature science, having been used for years in the petroleum industry as well as in recent studies for the Department of Energy nuclear waste isolation program.

U.S. EPA believes that the no-migration petition requirements are so stringent that if such a petition is approved for disposal of the ground water from Midco, deep well injection, even without treatment, will be considered to provide permanent protection to human health and the environment. If the deep well injection system receives approval from U.S. EPA, the injection will have no impact on USDW, which includes any residential wells.

Presently, four steel mills in northwest Indiana are legally injecting hazardous wastes into the Mount Simon aquifer located approximately 2200 feet below the surface. These include U.S. Steel, Inland Steel, Bethlehem Steel and Midwest Steel. Three of these facilities (Inland, Bethlehem and Midwest) have submitted a no-migration demonstration to U.S. EPA for approval in order to allow them to continue hazardous waste injection without treatment. U.S. Steel is expected to submit a demonstration soon. The hazardous wastes being injected are waste pickle liquor and waste ammonia liquor. U.S. EPA expects to make a decision on the no migration demonstrations for these facilities by March of 1990. If the no-migration demonstration is approved for these facilities, it is likely that a similar demonstration will be approved for Midco.

If the no-migration petition is not approved, the contaminated ground water from the Midco sites would have to be treated prior to the deep well injection. The required level of treatment is established nationally as the best demonstrated available treatment method for that type of waste.

It has been estimated that as many as 500,000 injection wells are in operation in the United States, but there are only 191 hazardous waste injection wells. These wells are concentrated in Texas, Louisiana, Illinois, Indiana, Michigan and Ohio. The oldest hazardous wastes injection well dates back to 1951. Use of hazardous waste injection wells underwent a thorough review by the Government Accounting Office in 1986. The results of their investigation are summarized in a document named "Hazardous Waste Controls Over Injection Well Disposal Operations", GAO/RCED-87-170, August 1987.

GAO determined that nationwide, two cases of USDW contamination have been documented by companies operating hazardous waste injection wells. In addition, one case of suspected contamination and eight cases of contamination of water that was already considered unsuitable for drinking have been documented. The USDW contamination occurred in Texas and Louisiana but was not extensive. Program controls now in place prohibit the practice that led to the two cases of drinking water contamination.

The leakage from hazardous waste injection wells into non-drinking water aquifers occurred at eight facilities between 1975 and 1984. The causes of the leakage centered on casing and/or tubing corrosion or deterioration. The most notable of these cases occurred at a commercial facility in Ohio in 1983 where large amounts of waste escaped into an unpermitted zone. This zone was, however, separated from the bottom of the lowermost USDW by more than 1500 feet, of which 1000 feet was confining rock formations. In response, to these and other concerns, and to the Congressional mandate for additional ground water monitoring requirements in the Safe Drinking Water Act Amendments of 1986, U.S. EPA is implementing stricter regulations. This includes:

- more specific well-siting requirements;
- an expanded "area of review" around injection wells for identifying abandoned wells near the injection site, and added requirements for corrective action to plug abandoned wells;
- additional operating procedures, such as automatic well shutoff or alarms; new requirements for testing, monitoring, and reporting, including a waste-analysis plan, additional mechanical integrity tests, and more specific monitoring requirements; and
- new requirements for well closure and post-closure care.

The GAO report also pointed out that the full extent to which injected hazardous waste has contaminated underground sources of drinking water is unknown because of the problems in detecting contamination that may have occurred away from the well-bore. The documented cases of contamination have all occurred near the well-bore. However, regulations require that injection wells not be located in areas where faults occur and that injection pressures be maintained below a level that might cause fractures in the formation. Regulations also require that all man-made holes in the area penetrating the confining zone and entering the injection zone be located and properly plugged. In addition, U.S. EPA is implementing requirements to monitor the migration of the waste movement.

The GAO report concluded that the new deep well injection requirements should provide additional safeguards to prevent the contamination of USDWs. In addition, well owners will be required to demonstrate no migration of hazardous waste.

COMMENT #2:

The City of Hammond comments included a statement that "Preferably the treatment would be to such an extent that the treated groundwater could be reinjected into the aquifer from where it originated."

U.S. EPA RESPONSE TO COMMENT #2:

See our response to Comment #5 below and to Comment #5 from the Midco Steering Committee and Morton-Thiokol.

COMMENT #3:

During the public meeting there were a number of comments concerning whether U.S. EPA puts too much emphasis on costs in its decisions on remedial actions, and whether alternative innovative treatment and disposal technologies were considered. Specific comments included the following:

> "All we're talking is cost effectiveness."
>
> "I don't think it's fair. I think cost should be put aside. These people that are going around polluting should be made to pay. ... It's not costs because these chemicals that leak out cause cancer and a number of other sicknesses. ... How do you put a price tag on one's life? Tell me."
>
> "Those responsible for creating environmental problems must pay the expense of correcting their mistakes."
>
> "They're supposed to be using the best available technology not the most cost effective."
>
> "Stop delving into the pockets of the public."
>
> "Why didn't they decide to use vitrification?"
>
> "I'd like to know if any of these people knew about "The Superfund Innovative Technology Evaluation Program Technology Profiles" or "Assessment of International Technologies for Superfund Applications."

U.S. EPA RESPONSE TO COMMENT #3:

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) was enacted in 1980 to provide broad federal authority and resources to respond to releases (or threatened releases) of hazardous substances. A trust fund was established to pay for remedial actions at abandoned or uncontrolled hazardous waste sites. This fund is predominantly from a tax on petroleum products and on certain chemicals.

Based on the principle that "the polluter should pay," CERCLA contains authorities which allow U.S. EPA to ensure that those responsible for hazardous waste problems pay for necessary remedial actions. CERCLA enforcement authorities enable U.S. EPA to encourage responsible parties to undertake remedial actions. It also enables U.S. EPA to spend trust fund monies for remedial actions and to later recover these monies from responsible parties.

If an acceptable agreement can be reached, U.S. EPA prefers that responsible parties implement the remedial actions. At Midco, an agreement was reached with potentially responsible parties (PRPs) in June 1985, which required the PRPs to reimburse U.S. EPA $3,100,000 for past costs incurred and to conduct a Remedial Investigation/Feasibility Study (RI/FS) at each site in accordance with the U.S. EPA's work plans. U.S. EPA is now negotiating with PRPs for implementation of the remedial actions selected by U.S. EPA and for recovery of the remaining costs incurred. Fund monies will be spent on the final remedial actions only if an agreement is not reached with PRPs.

In CERCLA (as amended by the Superfund Amendments and Reauthorization Act of 1986), Congress mandated that all final remedial actions selected by U.S. EPA must assure protection of human health and the environment, and must meet applicable, and relevant and appropriate Federal and State standards, requirements, criteria, and limitations (ARARs). This includes meeting Federal Primary Maximum Contaminant Levels in the ground water (40 CFR 142). Congress also mandated that U.S. EPA select remedial actions that are cost effective, and that utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. If a remedial action is selected that does not meet this preference, U.S. EPA must publish an explanation as to why a remedy involving such a remedial action was not selected.

The least costly alternative that would be protective of human health and the environment was the containment alternative (Alternative 3), which is estimated to cost $4.7 million at Midco I and $7.9 million at Midco II. U.S. EPA is not selecting these alternatives because they would simply contain the contamination, and the hazards would be similar to taking no action if the cap or slurry wall were ever damaged in the future. Instead, U.S. EPA is selecting remedial actions that it believes will provide permanent protection to human health and the environment. This consists of soil vapor extraction and solidification of contaminated soils combined with pumping and deep well injection of contaminated ground water at Midco I, and the same actions at Midco II except that the soil vapor extraction is not required. In addition, treatment prior to deep well injection will be required if a no-migration demonstration is not approved by U.S. EPA. The estimated cost of these remedial actions at Midco I is from $10.7 to $14.0 million, and at Midco II from $14.4 to $18.6 million (depending on the degree of treatment required prior to deep well injection).

The persons involved in reviewing the Feasibility Studies are familiar with "The Superfund Innovative Technology Evaluation Program: Technology Profiles." The Superfund Innovative Technology Program includes a number of studies on solidification, which is part of the selected remedial actions at the Midco sites. This includes processes by Chemfix Technologies, Hazcon, International Waste Technologies, Silicate Technology Corporation, and Soliditech. Soil vapor extraction, which is part of the remedial action at Midco I, is also included in this program in a process by Terra Vac. Other innovative technologies were considered for treatment of the contaminated soils at the Midco sites but were screened out because they were not considered applicable to the conditions at the site. These include in-situ biodegradation, soil flushing, and chemical treatment. In-situ vitrification and incineration alternatives were evaluated in detail. Vitrification was not selected because it has not been demonstrated to be implementable in a full scale remedial action at a hazardous waste site and because the high water table would make implementation difficult and more expensive. The incineration alternative does not suffer those disadvantages. However, both in-situ vitrification and incineration would be considerably more expensive than solidification and would not contribute significantly to the permanence of the remedial actions if the soil vapor extraction and solidification operations are successful.

Since a surface water discharge would probably not be approved for the salt contaminated ground water even after removal of the hazardous substances, the alternative to deep well injection of the ground water is to concentrate the solids in the ground water by an operation such as evaporation. Evaporation would concentrate at least some hazardous substances into a solid that would have to be disposed of in an off-site landfill. It does not appear that disposal of the hazardous wastes in an off-site landfill is any more protective of human health and the environment than disposal by deep well injection, and the costs of the evaporation operation would be higher than the deep well injection.

COMMENT #4:

"I've been involved in a couple projects, not in this state, where they used in conjunction with the slurry wall a well extraction, and then they leached it back in like a septic field. Then it recirculates. Are these contaminants able to be treated in that respect; and therefore, you wouldn't have deep well disposal and you wouldn't have a lot of things that would be objectionable at this point."

U.S. EPA RESPONSE TO COMMENT #4:

This method of treatment would not be adequate for the highly contaminated soils on the site, but it would be acceptable to U.S. EPA for ground water treatment when combined with a soil treatment measure.

Reinjection of the salt-contaminated ground water following treatment for hazardous substances would be acceptable to U.S. EPA if the reinjection does not cause significant spreading of the salt plume. Installation of a slurry wall and reinjection within the slurry wall is one way of preventing such spreading. This alternative is not preferred over deep well injection at the Midco sites for the following reasons: U.S. EPA believes that deep well injection can be accomplished safely and effectively; it is preferable to remove the salt contaminated ground water from the Calumet aquifer rather than containing it within a slurry wall; and there does not appear to be a cost savings using the slurry wall/reinjection alternative compared to deep well injection.

COMMENT #5:

"As a slurry wall contractor, I would like to comment on the slurry wall pricing listed in your Fact Sheet. I have never seen prices like these, and, as a contractor, I would like to know what they were based on. Today, our prices for Slurry Wall construction range from $3 to $5 per square foot and a bentonite cap $.50 per square foot."

U.S. EPA RESPONSE TO COMMENT #5:

The price estimates were developed by Dames and Moore, a consulting firm employed by the Midco Steering Committee. According U.S. EPAs's contact with this firm, the estimates were based on actual quotes from vendors. The costs were also reviewed by personnel from Roy F. Weston, Inc.

The prices are probably not comparable to the quotes suggested by the commenter because a different type of cap and slurry wall were proposed in the FS. The proposed cap is not just a single-layer bentonite cap. Instead, it is a multi-layered cap consistent with the most recent guidance for RCRA hazardous waste sites. It includes a clay liner, a synthetic liner, a lateral drainage layer, and a vegetative layer. Instead of installation of the slurry wall by the vibrating beam method, installation by a trench/slurry method was proposed. The proposed slurry wall would be approximately three feet thick while a slurry wall installed using the vibrating beam method is only a few inches thick. Safety considerations also add to the cost of actions at a hazardous waste site.

COMMENT #6:

"How deep, how far down has this pollution gone in the sites?"

U.S. EPA RESPONSE TO COMMENT #6:

The contamination appears to be confined to the Calumet aquifer, which extends approximately 30 feet below the surface at Midco I and 40-50 feet below the surface at Midco II. Below the Calumet aquifer is 90-100 feet of low permeability clays and tills.

COMMENT #7:

How many people review the chemical data, and how do the different agencies and other parties work together?

U.S. EPA RESPONSE TO COMMENT #7:

The chemical data was generated by a laboratory that conducted its own quality assurance/quality control (QA/QC) review of the data. The laboratory used in this project is also audited by the U.S. EPA. The chemical data was then sent to a contractor hired by the PRPs, who conducted an independent QA/QC review of the data. The contractor review was also audited by U.S. EPA. A QA/QC review of the data was conducted by a second contractor working for the PRPs.

The PRP contractors conducted an interpretive review of the data, and prepared a report that included plotting the distribution of data on a map, comparison to standards and a discussion of the data. This report was reviewed by at least five persons at U.S. EPA, six personnel working for U.S. EPA contractors, one person from the U.S. Fish & Wildlife Service, and three persons from the Indiana Department of Environmental Management.

U.S. EPA personnel reviewing the data included personnel from the air, water, Great Lakes and RCRA programs, who reviewed the report for concerns specifically related to their programs. The U.S. Fish & Wildlife Service reviewed the report for adequacy of information on ecological effects. Contractors working for U.S. EPA provided support to U.S. EPA with review of costs, hydrogeology, ground water modeling, risk assessment and other areas. A remedial project manager for the U.S. EPA provided an overall review and compiled the review comments from other agencies and contractors for transmittal to the contractor conducting the RI/FS for the Midco Steering Committee. Communications among U.S. EPA employees, other Federal agency employees and U.S. EPA contractors usually consist of informal discussions that are followed up by formal memos.

The Indiana Department of Environmental Management generally prepared their own comments in writing.

COMMENT #8:

"How are you monitoring landfills?"

U.S. EPA RESPONSE TO COMMENT #8:

Hazardous waste landfills are regulated by U.S. EPA under the Resource Conservation and Recovery Act (RCRA) and by the various states under acts similar to RCRA. Under these acts all hazardous wastes entering a landfill must be manifested. A copy of the manifest is sent back to the company that generated the hazardous waste and sometimes back to the state agency in order to verify that the shipment arrived.

The acts also regulate operation and monitoring of the hazardous waste landfills. Monitoring requirements include periodic sampling of ground water near the landfill. Self-monitoring reports including ground water sampling data are periodically sent from the landfill to the agency responsible for oversight of these facilities (which can be Federal or state agencies). Each hazardous waste landfill is also inspected periodically by a state or Federal inspector.

Sanitary landfills are regulated primarily by the states. The IDEM inspects sanitary landfills periodically and requires that ground water monitoring be conducted.

COMMENT #9:

One resident of Gary, Indiana expressed the following concern: "I am concerned by the EPA studies performed on the Porter and Lake County wells which concluded their well water was unsafe to drink. I am requesting that (1) the EPA conduct a study to determine the quality of my neighbors' well as my own..."

U.S. EPA RESPONSE TO COMMENT #9:

The Porter County study referred to is an investigation conducted by the Porter County Health Department of the effects of three landfills in Porter County, Indiana on residential and monitoring wells near the landfills. These landfills will have no impact on well water in Gary, Indiana.

The well of concern is located near 17th and Baker Street in Gary. The identified hazardous waste sites closest to the resident are Midco I and Ninth Avenue Dump (which are approximately two miles away), and Lake Sandy Jo and the Gary City Landfill (which are approximately one mile away). U.S. EPA has conducted detailed investigations at each of these sites. The well of concern was not included in these studies because it was considered to be outside of the area that could be affected by the sites. The results of the investigations confirmed that none of these sites will have any impact on the well of concern. Furthermore, U.S. EPA will conduct remedial actions at the Midco I, Ninth Avenue Dump, and Lake Sandy Jo sites that will eliminate significant health risks, if any, from the sites even to the residents closest to the sites. Ground water at the Gary Landfill is being pumped in a manner that is preventing ground water from the site from flowing off-site.

COMMENT #10:

"If the U.S. EPA would choose an alternative using incineration, we ask that Ordinance #5090, passed by the Common Council of the City of Hammond, be incorporated into the design parameters. We feel the standards incorporated into Ordinance #5090 will protect the health and welfare of those citizens who live adjacent to the site."

U.S.EPA RESPONSE TO COMMENT #10:

The alternative selected by U.S. EPA in this ROD does not include incineration. If incineration was conducted, the U.S. EPA would not consider the City of Hammond's incinerator regulations to be either an applicable, or relevant and appropriate requirement since the operation would be conducted outside the city limits of Hammond. However, U.S. EPA will likely reach similar goals through requiring compliance with standards set by the RCRA, TSCA and CERCLA programs. These include the following:

1) Each principal organic hazardous constituent in the waste must be reduced to 0.01% of the original concentration before emission into the air. The RCRA program refers to this as 99.99% destruction and removal efficiency. Some of the more toxic compounds, including polychlorinated biphenyls, must be reduced to 0.0001% of the original concentration.

2) Hydrochloric acid emissions, if greater than 4 pounds per hour, must be reduced by 99%. Emissions of particulate matter may not exceed 0.08 grains per dry standard cubic foot.

B. SUMMARY OF COMMENTS FROM THE INDIANA DEPARTMENT OF HIGHWAYS:

COMMENT #1:

"The FS report fails to clearly define the contaminant transport mechanism that has caused dissolved salt contaminants (e.g. chlorides) to migrate from the IDOH Subdistrict site, against the prevailing ground water flow direction and hydraulic gradient, and be deposited in the ground water underlying the Midco I site."

U.S. EPA RESPONSE TO COMMENT #1:

The mechanism is explained on pages 1-13, 4-19, and 5-32 of the "Remedial Investigation of Midwest Solvent Recovery, Inc. (Midco I)" dated December 1987, as follows: "Chloride values were also high (up to 7,700 mg/l) in shallow wells (10-foot-deep) in a band extending through the middle portion of the site (MW7, MW6, MW5, Figure 5-25). ... This band occurs in a former swale area that received run-off from the Indiana State Highway Department property prior to Midco I as documented on September 1973 aerial photographs. The evidence suggests that chloride in the shallow wells was derived from concentrated NaCl surface run-off percolating downward to ground water in the former swale area."

COMMENT #2:

"It is plausible that other chloride-containing wastes (e.g., pickle liquor, waste oils containing chlorinated paraffins, etc.) were improperly managed or disposed of on the Midco I site and that IDOH is, therefore, not the sole source of chloride contamination in the site area."

U.S. EPA RESPONSE TO COMMENT #2:

U.S. EPA agrees that the Midco I site operations likely made a contribution to the salt contamination in the ground water below and down gradient from the site. U.S. EPA believes that both IDOH and the Midco I operations contributed to this salt contamination, but the amount attributable to each source cannot be determined.

COMMENT #3:

"Also the FS report fails to distinguish between reactive cyanides, which were likely present on Midco I, and complexed ferrocyanide, which was used by IDOH as an anti-caking agent in the salt. The complexed ferrocyanide poses little risk to human health or the environment under most conditions, while the reactive forms are of greater environmental concern. "Additional technical evaluation of the type, distribution, and potential impact of the cyanide contaminants in the subsurface environment should be conducted."

U.S. EPA RESPONSE TO COMMENT #3:

Four rounds of sampling were conducted for cyanide. The last round included tests for cyanide amenable to chlorination as well as total cyanide. U.S. EPA agrees that reactive forms of cyanide (some of which were likely disposed of at Midco I) are more hazardous to human health and the environment than complexed ferrocyanide.

COMMENT #4:

FS Figure 1-32 showing the distribution of cyanide in the aquifer is misleading and improperly constructed.

U.S. EPA RESPONSE TO COMMENT #4:

U.S. EPA agrees that Figure 1-32 in the draft FS was misleading and improperly constructed. This Figure was removed from the final FS report, at the request of U.S. EPA. U.S. EPA agrees that the highest cyanide concentrations are in the east-central portion of the Midco I site.

COMMENT #5:

"CALs (cleanup action levels) have not been established for chlorides in soil, ground water, or surface waters at the Midco I site, an apparent indication that no site-specific health or risk-based factors have been determined for this parameter."

U.S. EPA RESPONSE TO COMMENT #5:

The salt contamination in the ground water has been viewed as a concern primarily because of the loss of a resource (that is, usage of the ground water) rather than as a human health or environmental hazard. In spite of this, there are some human health and environmental hazards from the salt contamination. Sodium greater than 20 mg/l in drinking water can have a negative health effect on persons on a low sodium diet. High salt content can also have an impact on fresh water aquatic life.

COMMENT #6:

"An independent study commissioned by IDOH did not disclose total cyanide in surface and subsurface soils at concentrations exceeding the soil CAL (136 ppm); the soil levels detected were typically 1 to 2 orders of magnitude below the CAL. Only 2 of 16 ground water samples collected from monitoring wells on the IDOH property exceeded the ground water CAL for cyanide (10.4 ppb).

U.S. EPA RESPONSE TO COMMENT #6:

U.S. EPA can respond to this comment once the referenced data has been sent to U.S. EPA for review.

COMMENT #7:

IDOH recommended that the alternative of discharge to the City of Hammond sewer system be reevaluated. It was argued that the discharge of salt from the Midco I ground water, would be minor compared to the present salt load discharged to the Hammond Wastewater Treatment Plant.

U.S. EPA RESPONSE TO COMMENT #7:

In general, discharge of highly saline wastewater to a POTW is not allowed due to potential interference in the biological treatment processes. In addition, the Hammond Wastewater Treatment Plant is already exceeding its discharge limitation for chloride. The highly salt contaminated discharge from Midco I would cause an even greater exceedance. Discharge to the Hammond Wastewater Treatment Plant may also be restricted by the U.S. EPA off-site policy, which requires that facilities used for disposal of wastes in the CERCLA program must be in compliance with applicable Federal and State regulations.

C. Comments from the Midco Steering Committee and from Morton Thiokol, Inc.:

COMMENT #1:

U.S. EPA did not select a cost-effective remedy for soils or ground water.

U.S. EPA RESPONSE TO COMMENT #1

See U.S. EPA's response to the following comments from the Midco Steering Committee and the response to Comment #3 from the public meeting, etc.

COMMENT #2:

The assumptions used in the risk assessment are unrealistic.

U.S. EPA RESPONSE TO COMMENT #2:

U.S. EPA required that the risk assessment include a scenario that assumed that each site would be developed for residential or industrial use. This is a standard procedure for CERCLA sites. The particular assumptions used in the risk assessment had to be consistent with standard U.S. EPA risk assessment practices as expressed in the Superfund Public Health Evaluation Manual (SPHEM). Parameters and assumptions that were not spelled out in the SPHEM were selected by Environmental Resources Management Inc. with review and concurrence by U.S. EPA.

COMMENT #2A:

Ingestion rates and dermal contact rates for the contaminated soils were unrealistic. In addition, it is unrealistic to assume that there would be no degradation of contaminants over time.

U.S. EPA RESPONSE TO COMMENT 2A:

U.S. EPA's current guidance for soil ingestion rates for use in CERCLA and RCRA risk assessments is more stringent than that used in the FSs. To promote consistency within the Agency, U.S. EPA has recommended soil ingestion rates for use in risk assessments in a memo from J. Winston Porter dated January 7, 1989. These rates are 0.1 grams per day for adults and 0.2 grams per day for children ages 1-6. These rates are based on the most recent reliable data reviewed by the Agency, and represent reasonable conservative values. The guidance does not address children who exhibit pica behavior because the occurrence of pica behavior and the associated rates of soil ingestion have not been adequately defined. The FS assumed that 1 gram per day would be ingested by children ages 2-6, 0.1 gram per day for children ages 6-12 (only for Midco I), and no ingestion after that age.

The estimated, lifetime cancer risk is proportional to the total lifetime exposure. Using the assumptions in the Midco Feasibility Study (FS) the total lifetime amount of soil ingestion is between 1,715 and 2,044 grams. Using the new recommended rates, the lifetime soil ingestion is 2,774 grams. As can be seen, the lifetime cancer risk estimate will be higher using the new rates than the rates used in the FS. In addition, using the assumptions in the FS, there would be no further exposure following the age of 12, but using the new rates there would be continued exposure.

The risks from soil ingestion in the industrial development scenario are less than in the residential development scenario, but are still substantial. Some types of exposure that can occur after age 12 could also occur under the industrial development scenario. Assuming 30 years of exposure at 0.1 gram per day equals 1,095 grams in a lifetime using the industrial development scenario. This is approximately 60% of the lifetime ingestion used for risk calculations in the FS, and, therefore, the same percentage of the lifetime, carcinogenic risk.

The dermal contact rates used in the FS were proposed by Environmental Resources Management. Personnel from U.S. EPA and PRC Environmental Management, Inc. (PRC) reviewed the proposed rates and felt that they were reasonable conservative assumptions.

Degradation/removal of contaminants does occur over time due to volatilization and biodegradation. However, the rate of these processes is generally very slow for some of the chemicals of most concern, including polychlorinated biphenyls, lead, arsenic, and polyaromatic hydrocarbons.

COMMENT #2B:

It is unrealistic to assume that residential development could occur at these sites. In addition, Midco II is included in the City of Gary airport's expansion plans.

U.S. EPA RESPONSE TO COMMENT #2B:

U.S. EPA disagrees with this assertion. While it is not possible to know whether residential development will occur, it appears to be quite possible since there are already residences located in industrial areas near these sites. This includes a residence located 500 feet south of the Midco I site on Blaine Street. It is across the street from Calumet Waste Systems and near General Drainage. The residents at this location utilize the Calumet aquifer for drinking and have a garden. Another property adjacent to General Drainage is used for gardening by a Hammond resident.

There are a number of residences at the corner of Clark Road and Industrial Highway, which is one mile southeast of Midco II. These residences are across the street from House's Junk Yard, and adjacent to Samocki Brothers Trucking. Two of the residences formerly used the Calumet aquifer for drinking, and a number of the residences have gardens.

The Gary City Airport is one of three sites being considered for the third regional airport for the Chicago area. If the Gary Airport site is selected, the Midco II property may be incorporated into the airport. However, this is still very uncertain. Even if Midco II is incorporated into the Gary City Airport, this may not eliminate the risks from contact with the contaminated soils or ground water if no action is taken.

COMMENT #2C:

It is unrealistic to assume this ground water may be used for drinking (at an ingestion rate of two liters per day), and for bathing because of the salt contamination in the aquifer and difficulty in obtaining a permit for well installation.

U.S. EPA RESPONSE TO COMMENT #2C:

The most contaminated portions of the Calumet aquifer at each site is in the shallow portion of the aquifer. In the shallow portion, chloride was generally in the range of 1,000 mg/l at each site. Water is drinkable with this concentration of chloride, although it has an undesirable taste. Two residences near the corner of Clark Road and Industrial Highway formerly utilized wells that only pumped from the shallow portion of the Calumet aquifer. This is evidenced by statements by the residents that their wells ran dry due to pumping at Samocki Brothers.

Ground water contaminated with 1,000 mg/l chloride is common in sanitary landfill plumes. If a landfill site is on the National Priorities List and the plume contains hazardous substances above cleanup action levels, remediation of the plume is often required by U.S. EPA under CERCLA irrespective of the presence of the chloride plume or the fact that the hazardous waste contributors may not have been the primary cause of the chloride contamination. Similarly, the hazardous substances from the Midco sites must be remediated irrespective of the presence or the source of the chloride contamination.

Besides the three residential wells previously mentioned, sixteen residential drinking water wells were located in the City of Gary that are potentially down gradient from Midco I. Since the State of Indiana had no record of these wells, it appears that none of them had a permit.

For the industrial development scenario, the risk level would be similar to that for residential development because the primary risk is due to ground water ingestion. In an industrial situation, actual water consumption depends on the level of activity and the work environment. For extreme cases, consumption of as much as 19 liters of water per day can be normal. A standard consumption figure of 2 liters/day is reasonable for both 1) total daily consumption by the general population and 2) working day consumption by a mix of workers.

COMMENT #2D:

The risk assessment should take into account the number of persons exposed and the risk compared to other cancer agents.

U.S. EPA RESPONSE TO COMMENT 2D:

The SPHEM and Agency policy for risks assessments for CERCLA sites address both future potential risk and present risk. As a result, under CERCLA, U.S. EPA often bases its remedial actions more on potential for usage of an aquifer or for future development of a site than on the present population affected. At the Midco sites, U.S. EPA is taking into account that the Calumet aquifer is little used and has other contaminant sources by only requiring clean up to the 10^{-5} lifetime carcinogenic risk level rather than the 10^{-6} risk level that is normally required in Region V. In addition, the potential for development of Midco II is considered to be lower than usual; thus the 10^{-5} risk level is being used for the soil clean up.

Under CERCLA and RCRA, Congress has mandated that U.S. EPA address and remediate risks from hazardous waste management and disposal. It is U.S. EPA's responsibility to address and remediate these risks irrespective of other risks that are present in every day life.

COMMENT #3:

Direct soil treatment is unnecessary, and Alternatives 7 and 8 (which include direct soil treatment by solidification and soil vapor extraction as well as a final site cover and ground water pumping), do not provide any reduction in institutional controls or significant additional protection compared to Alternatives 4A and 4C (which only include ground water pumping and installation of a final site cover).

U.S. EPA RESPONSE TO COMMENT #3:

The Midco Steering Committee proposes that Alternatives 4A or 4C include a silty clay cover so that contaminants in the soils would be slowly leached into the ground water and recovered in the ground water pump and treatment system.

Alternatives 4A and 4C would leave a large reservoir of untreated hazardous substances in the on-site soils. At Midco I, this includes an estimated 70,000 lbs. of volatile organic compounds, 60,000 lbs. of copper, 30,000 lbs. of zinc, 20,000 lbs. of chromium, 10,000 lbs. of lead, 10,000 lbs. of phenol, 10,000 lbs. of cyanide, 7,000 lbs. of bis(2-ethyl-hexyl)phthalate), 5,000 lbs. of polyaromatic hydrocarbons, and 100 lbs. of polyaromatic hydrocarbons. At Midco II, this includes an estimated 100,000 lbs. of copper, 70,000 lbs. of zinc, 30,000 lbs. of lead, 20,000 lbs. of volatile organic compounds, 20,000 lbs. of chromium, 8,000 lbs. of arsenic, 1,000 lbs. of cyanide, and 400 lbs. of polychlorinated biphenyls. These weights are calculated by multiplying the trench average concentrations by the estimated pounds of soils to be treated, assuming that one cubic yard equals one ton.

This large reservoir of hazardous substances presents a future risk due to its potential to continue contamination of the aquifer and due to potential for direct ingestion and direct contact hazards. It appears very unlikely that this large reservoir of contamination will be adequately removed using only passive uncontrolled natural leaching even for a long period of time. It is quite possible that, if the site cap is disturbed in the future, renewed ground water contamination would be caused even after many years of ground water pumping and attainment of ground water cleanup action levels. Leaving the hazardous substance reservoir without treatment, would also require that the ground water pumping system operate for a much longer period of time.

Although the predominant risk is due to ground water ingestion in the future usage scenario, the risks due to direct soil ingestion are also likely to be unacceptable in case of future development of the site, if the contaminated soils are not treated. A number of the chemicals of most concern for the soil ingestion hazard are relatively immobile in soils. This includes arsenic, polyaromatic hydrocarbons, polychlorinated biphenyls, bis(2-ethylhexyl)phthalate, and lead. Even if these chemicals alone remained in the contaminated soils at or near their present concentrations, the residual risks due to soil ingestion would be unacceptable. At Midco I, the estimated lifetime cancer risk would be 3 X 10^{-5}, and at Midco II, 3 X 10^{-4}. In addition, unacceptable subchronic risks would remain for lead and bis(2-ethylhexyl)phthalate at Midco I, and an unacceptable chronic non-carcinogenic risk would remain at Midco II because of arsenic. The risk levels used above are from the "Addendum to Public Comment Feasibility Study" dated March 7, 1989, except for the subchronic risk, which is from the Remedial Investigation.

A further justification for direct treatment of the contaminated soils at Midco I and Midco II is that concentrations of some chemicals are similar to concentrations in some listed hazardous wastes, for which treatment is required prior to land disposal under the Land Disposal Restrictions (40 CFR 268). This includes chromium and lead at Midco I, and chromium, lead and arsenic at Midco II.

The remaining health risks due to ingestion of the contaminated soils for Alternatives 4A and 4C could be controlled by access restrictions. However, Congress has mandated that U.S. EPA implement remedial actions that utilize treatment to permanently reduce the toxicity, mobility or volume of hazardous substances to the extent practical. Given the Statute's preference and the uncertainty of their long term effectiveness, U.S. EPA seeks to avoid primary reliance on access restrictions, institutional controls and containment measures. U.S. EPA believes that solidification combined with soil vapor extraction will provide permanent protection from the hazards due to the contaminated soils at this site (if treatability tests show they will work). However, since solidification of hazardous wastes has not been practiced long enough to fully evaluate its long term effectiveness, long term monitoring and institutional controls will be required for Alternatives 7 and 8.

COMMENT #4:

The effectiveness of the solidification/stabilization process is uncertain.

U.S. EPA RESPONSE TO COMMENT #4:

The solidification/stabilization (S/S) has been selected as the best demonstrated available technology for treatment of hazardous wastes containing cadmium, chromium, lead, nickel, silver, arsenic and selenium. This is based on results of tests listed in an attachment to this ROD. While S/S may not be effective in immobilizing organic compounds, tests have shown that organic contaminated soils can be solidified into a low permeability, high compressive strength material. The Record of Decision for each site provides for adjustment of the quality of the final site cover depending on the degree of effectiveness of the solidification process. If after solidification, significant potential for future ground water contamination exists, then an extremely impermeable cap such as the one described for

Alternative 2 in the FS, may be required. If solidification is very effective, a less complex final site cover would be acceptable.

U.S. EPA has a strong preference for permanent remedial actions, and believes that incineration followed by solidification is more certain to provide permanent treatment of the contaminated soils. Incineration would reliably, and permanently destroy the organic contaminants and would leave a residual ash that could be more easily solidified because the organic compounds would be removed. On the other hand, incineration is considerably more expensive and solidification combined with soil vapor extraction has the potential to provide the same degree of protection. Therefore, at this time, U.S. EPA prefers to implement the solidification alternative pending the results of the treatability tests.

COMMENT #5:

"Solidification of the Midco II soils might interfere with and preclude the contemplated expansion of the City of Gary Airport."

U.S. EPA RESPONSE TO COMMENT #5:

Measures will be taken to make the remedial actions at Midco II compatible with the Gary Airport expansion if this occurs.

COMMENT #6:

The harm caused by releases of the chlorides to the ground water is divisible from any impact from the Midco sites and costs can be apportioned for the chloride contamination.

U.S. EPA RESPONSE TO COMMENT #6:

While U.S. EPA does not agree with this statement, it is not relevant to the selection of a remedy, but rather to the liability ramifications. U.S. EPA noted that the Midco operations themselves likely contributed to the chloride contamination. Available site records indicate that 39,010 gallons ferric and ferric chloride wastes and 60,755 gallons of liquid waste containing 5% HCl were taken to Midco I or Midco II. Other wastes taken to the sites, whose records do not identify the waste type, may also have contained high chlorides. Some of these wastes were likely spilled onto the ground or dumped into pits into the aquifer in accordance with the disposal practices for these sites. In addition, at Midco I, the swales in the northern half of the site were filled with unknown materials during the Midco operations. It is possible that this fill contributed to the chloride contamination at Midco I.

Moreover, U.S. EPA does not agree with the suggested procedure for calculation of the incremental remedial action costs attributable to the salt contamination. The procedure proposed by the Midco Steering Committee assumes that all costs of the deep well injection operation should be considered incremental costs attributable to the salt contamination. This is not correct, because the costs for treatment are substantially reduced when using the deep well injection alternative compared to the treatment costs for discharge to surface waters or to ground water (even without treatment of the salt). In fact, deep well injection without treatment could be less expensive than treating to surface water discharge standards or to drinking water standards (even without treatment of the salt). For example, the estimated incremental cost for treating the ground water to drinking water standards (other than chlorides) at Midco I is $3,938,000 (present worth of alternative 4C minus 4A plus $675,000 for the petition demonstration), while the costs attributable to the deep well injection operation in Alternative 4A is $3,137,000. Similarly, at Midco II the estimated incremental cost of treating to drinking water standards is $4,910,000, while the cost attributable to the deep well injection operation in Alternative 4A is $3,491,000.

If treatment to meet Land Disposal Restrictions is required prior to the deep well injection, then the cost of the deep well injection system would be increased considerably, but the degree of treatment required would still be less than that required for reinjection into the Calumet aquifer or for discharge to the Grand Calumet River.

The primary objective of the remedial actions at the Midco I and Midco II sites is to address the contamination by hazardous substances and not by chlorides. Nevertheless, chlorides that are captured by the ground water treatment system must be disposed of properly. This is consistent with the approach that U.S. EPA takes at other sites. For example, at landfill sites, chlorides are often mixed with the hazardous waste plume. In spite of the fact that the primary objective of remedial actions at these sites is to address the hazardous substances and not the chloride plume, the chlorides that are present in any ground water pumped from the ground must be properly disposed of by the party conducting the remedial action at landfill sites.

COMMENT #7:

The State of Indiana should issue a variance allowing the discharge of the treated Midco I ground water to the Calumet aquifer:

U.S. EPA RESPONSE TO COMMENT #7:

The State of Indiana does not have primacy for the underground injection control program. Therefore, any underground injection must be approved by U.S. EPA. The reinjection well would be considered class IV unless the waste is delisted, since the ground water contains listed hazardous wastes. This reinjection is not prohibited if it is conducted for cleanup of a release under CERCLA or RCRA. CERCLA will allow this reinjection if the contaminated ground water meets the cleanup action levels and does not allow significant spreading of the salt plume.

For clarification, there appears to be three ways to reinject without spreading the salt plume. One would be to construct a slurry wall around the site, pump and treat the ground water within the site, and reinject the ground water within the slurry wall. Another alternative would be to pump and treat the ground water for both hazardous substances and chlorides (such as by evaporation) and reinject the treated ground water off-site (Alternative 4E). The third is to pump ground water, treat it and reinject it near the site in a manner that would not spread the salt plume.

COMMENT #7:

The State of Indiana should issue a National Pollutant Discharge Elimination System permit allowing the discharge of the salty ground water to the Grand Calumet River following treatment of hazardous substances.

U.S. EPA RESPONSE TO COMMENT #7:

Dames and Moore, who conducted the FS for the Midco Steering Committee, concluded that the State of Indiana would not allow a discharge to the Grand Calumet River without reducing chloride levels. However, in order to respond to the comment from the Midco Steering Committee, U.S. EPA has contacted IDEM and conducted some additional internal discussions. Personnel with the IDEM water compliance section stated verbally that a preliminary review of data from the Grand Calumet River indicated that no excess capacity exists in the chloride allocations for the Grand Calumet River, and that preliminarily, it did not appear that the State would allow a discharge with a chloride concentration higher than 500 mg/l for the Midco sites. U.S. EPA followed up these conversations with a letter requesting a formal determination on this matter.

COMMENT #8:

Cleanup action levels should be periodically revised.

U.S. EPA RESPONSE TO COMMENT #8:

This is provided for in the RODs.

COMMENT #9:

Only one deep well should be installed to serve both of the Midco sites.

U.S. EPA RESPONSE TO COMMENT #9:

This is allowed for in the RODs. However, it is not clear why the Steering Committee feels the shared well should be located at Midco I, since Midco II will have a higher flow rate and has a larger area.

COMMENT #10

"The U.S. EPA and the State should seriously consider prohibiting use of the Calumet aquifer as a source of drinking water due to the salinity issue."

U.S. EPA RESPONSE TO COMMENT #10

The results of the Midco Remedial Investigations indicated that the salt contamination had only affected limited portions of the Calumet aquifer. Although the Calumet aquifer is susceptible to contamination by surface sources, it is the intent of RCRA and CERCLA to control or remediate these potential contaminant sources so that aquifers like the Calumet aquifer can be safely used.

A GUIDE
to the
FEDERAL
UNDERGROUND INJECTION
CONTROL PROGRAM
in
INDIANA

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to the
U. S. Environmental
Protection Agency
Region V
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Chicago, IL 60604

About the Guide

This guide is intended to familiarize the public with the regulations for the Underground Injection Control (UIC) Program. Technical criteria for the program were published in the Federal Register June 24, 1980 and codified as Part 146 of Title 40, Code of Federal Regulations. Procedural requirements, state approval process, and the permit issuing process were promulgated on May 19, 1980 as part of the Consolidated Permit Regulations as revisions to 40 CFR, Parts 122, 123 and 124. The Part 122 and 123 Regulations were deconsolidated as technical amendments on April 1, 1983 (48 Fed. Reg. 14145) and now appear as Parts 144 and 145 of 40 CFR.

Subsequent to the promulgation of these regulations, the Safe Drinking Water Act was amended. Among other changes, the amendments added a new Section 1425 to the Act. Section 1425 establised an alternative method for a state to obtain primary enforcement responsibility for those portions of its UIC program related to the recovery and production of oil and gas. The May 19, 1981 Federal Register (Vol. 46, No. 96, p. 27333) contains Section 1425 guidelines.

Also, the Environmental Protection Agency amended the regulations listed above on August 27, 1981 and February 3, 1982. These amendments were promulgated as part of a legal settlement reached with a number of companies, trade associations, and the State of Texas.

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I. THE UIC PROGRAM IN PERSPECTIVE

National Concern for Ground Water

Most areas of the United States are underlain by geological formations or strata that are capable of yielding usable quantities of water. Such geological formations are called aquifers.

People have long relied on aquifers as the source of high-quality water. Today, about half of the American population uses ground water for its domestic needs.

In the arid areas of the country, aquifers are often the only source of water available. And with increased usage of water by industry, homes, and municipalities, national reliance on ground water is expected to increase.

Ground water is also a vital link in the water cycle. Aquifers are replenished by rainfall or other surface water percolating through the soil. In turn, ground water supplies the base flow of many streams and feeds lakes through underground springs.

Recent years have seen a growing concern for the quality of ground water. Pollutants in surface waters or substance deposited on the soil (e.g., pesticides and fertilizers) may be carried into aquifers in the replenishment process. The land disposal of wastes (e.g., into injection wells, landfills, and surface impoundments) can also cause contaminants to enter ground water.

Injection wells can be either beneficial or a major problem in this regard. It is estimated that perhaps as many as 500,000 injection wells are in operation nationwide. These wells involve a broad variety of practices from beneficial purposes (e.g., aquifer recharge and the production of oil, gas and minerals), to the improper disposal of toxic and hazardous wastes.

The contamination of ground water is a matter of grave concern. Ground water is usually assumed to be of high quality and is often used with little or no treatment. Contamination is usually discovered when the consumer becomes ill and, in many cases, the only practical solution is to search for another source of fresh water. Because of the slow movement of ground water, it may be decades or even centuries before the aquifer is once more usable. In some cases, the contamination can never be reversed and the resource may be lost forever. Finally, the effort to clean up the nation's surface waters is hampered if the base flow of streams is already contaminated.

Congress Acts

Congress recognized these potential threats to ground water when, in the Safe Drinking Water Act of 1974

(P.L. 93-523), it instructed the Environmental Protection Agency (EPA) to establish a national program to prevent underground injections which endanger drinking water sources. More specifically, the Safe Drinking Water Act (SDWA) requires EPA to:

- Publish minimum national requirements for effective State Underground Injection Control (UIC) programs.
- List states that need UIC programs.
- Make grants to states for developing and implementing UIC programs.
- Review proposed state programs and approve or disapprove them.
- Promulgate and enforce UIC programs in listed states if the state chooses not to participate or does not develop and operate an approvable program.

Several points are worth noting about the statutory mandate. First, the SDWA was intended to head off what Congress perceived as an emerging problem. The committee report accompanying the Act (H. Rept. 93-1185, p. 32) makes clear that no burden is laid on EPA or the state to prove actual contamination before establishing regulations or enforcing them. Second, UIC is clearly to remain a state program. States are expected to assume primary responsibility for fashioning and operating effective programs in their states. The EPA is required to step in only if a state chooses not to participate in the program or fails to administer its program effectively. EPA also has direct responsibility on Indian lands. Third, Congress enjoined EPA to observe three provisions in establishing regulations. The regulations:

- o Are not to interfere with or impede oil and gas production unless necessary to protect underground sources of drinking water.
- o Are not to disrupt effective existing state programs unnecessarily.
- o Are to take local variations in geology, hydrology and history into account.

Background of the Regulations

EPA originally proposed regulations to implement Part C of the Safe Drinking Water Act (SDWA) on August 31, 1976. That proposal included the program regulations and the technical criteria and standards for the UIC program. Numerous written comments were filed and many persons commented at three public hearings.

After careful review of those public comments, EPA determined that there were many ways that the initial proposal could be made generally more flexible and less burdensome without

sacrificing the resulting environmental protection to any significant degree. Further, in the fall of 1978, the Agency decided to consolidate the regulations for its major permit programs.

As a consequence of these decisions, the UIC program regulations were reproposed on April 20 and June 14, 1979.

After five public hearings and review of public comments the Agency promulgated final Consolidated Permits Regulations on May 19, 1980 and Technical Criteria for state UIC programs, on June 24, 1980.

A number of trade associations, mining companies, oil and gas producers, iron and steel producers, and the State of Texas petitioned for review of these regulations. In all a list of 93 issues was filed by the petitioners with the Court of Appeals for the District of Columbia Circuit. In response to the legal challenge, the Agency proposed amendments to the regulations on October 1, 1982 and promulgated final amendments to its Consolidated Permit Regulations and Technical Criteria and Standards for state UIC programs on August 27, 1981 and February 3, 1982. However, on April 1, 1983, the UIC regulations were deconsolidated from EPA's other permitting programs.

Thus, public comments, further study, amended legislation and internal management improvements are the principal foundations of the UIC program.

II. MAJOR CONCEPTS OF THE UNDERGROUND INJECTION CONTROL PROGRAM

Congress intended the UIC program to protect not only the ground water which already serves a source of drinking water but also the ground water that could potentially serve as an underground source of drinking water (USDW). The regulations propose, therefore, that all aquifers or portions of aquifers currentl serving as drinking water sources be designated for protection. Furthermore, any other aquifer or portion of it which is capable of yielding water containing 10,000 or fewer milligrams per liter of total dissolved solids should also be designated.

However, not all underground water sources are suitable for providing drinking water. Some aquifers are used for producing minerals, oil and gas, or geothermal energy. Others are so contaminated or located in such a manner that recovery of water for drinking purposes is neither economically practical nor technologically feasible. An exempted aquifer is an aquifer or portion which would normally qualify as a USDW but which for any of several specified reasons has no actual potential for providing drinking water and has been affirmatively identified by EPA as an exempted aquifer. If EPA exempts an aquifer or portion of an aquifer, it is not treated as a USDW subject to the protections of these regulations.

Some Significant Terms Used in the UIC Program

Aquifer - Any geologic formation which is capable of yielding usable quantities of ground water.

Well - A bored, drilled, or driven shaft, or dug hole, whose depth is greater than the largest surface dimension.

Well Injection - The emplacement of fluids into the ground (except drilling muds and similar materials used in well construction) through a bored, drilled, driven or dug well.

Fluids - Materials or substances which flow or move, whether semi-solid, liquid, sludge, or any other form or state.

Mechanical Integrity - A general standard for injection wells which signifies that there is no: (1) significant leakage in the well's casing, tubing or packer; and (2) significant movement of fluids between the outermost casing and the well bore.

Migration of Fluids - The movement of fluids from the well or the injection zone into underground sources of drinking water.

Area of Review - The area on the surface surrounding an injection well within which all wells that penetrate the injection zone must be reviewed and, if necessary, repaired. It may be defined in terms of a fixed radius of not less than 1/4 mile from the injection well. Alternatively, the area of review may be computed by the use of a mathematical formula which predicts the lateral distance over which the incremental pressure generated by the injection may cause the upward migration of fluids from the injection zone through faults, improperly abandoned wells, or improperly completed producing wells.

Potential Pathways of Contamination

The basic concept of the proposed UIC program is to prevent the contamination of underground sources of drinking water by keeping injected fluids within the well and in the intended injection zone. There are five major ways in which injection practices can cause fluids to migrate into underground drinking water sources. The following discussion describes each pathway and summarizes the technical requirements proposed in the regulations to prevent migration through that pathway.

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1. Faulty Well Construction

Leaks through the well casing or fluid forced back up between the well's outer casing and the well bore, as illustrated in Figure 1, may cause contaminant migration into a USDW.

Preventive Requirements

The regulations require adequate casing to protect drinking water sources, and adequate cementing to isolate the injection zone. Mechanical integrity, defined as the absence of significant leaks and fluid movement in the well bore, must be demonstrated initially and every five years thereafter.

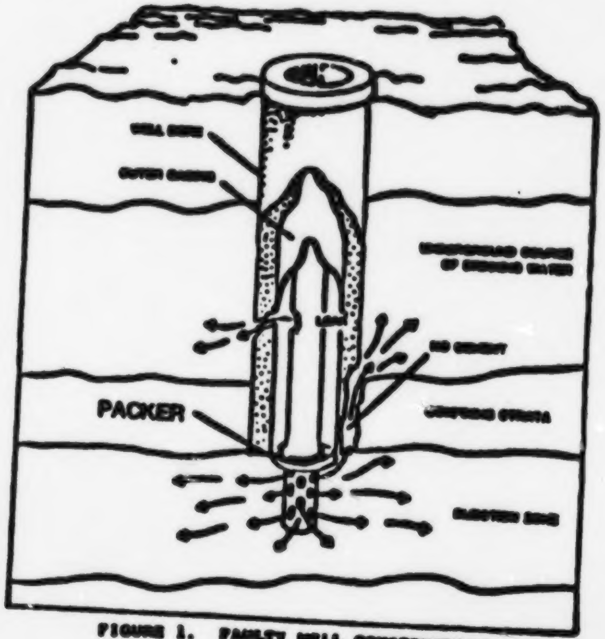


FIGURE 1. FAULTY WELL CONSTRUCTION

2. Nearby Wells

Fluids from the pressurized area in the injection zone may be forced upward through nearby wells into underground sources of drinking water, as illustrated in Figure 2.

Preventive Requirements

Wells that penetrate the injection zone in the area of review must be reviewed to assure that they are properly completed or plugged. Corrective action must be taken if they are not completed or plugged to prevent fluid migration. Newly abandoned wells must be plugged to conform with EPA procedures.

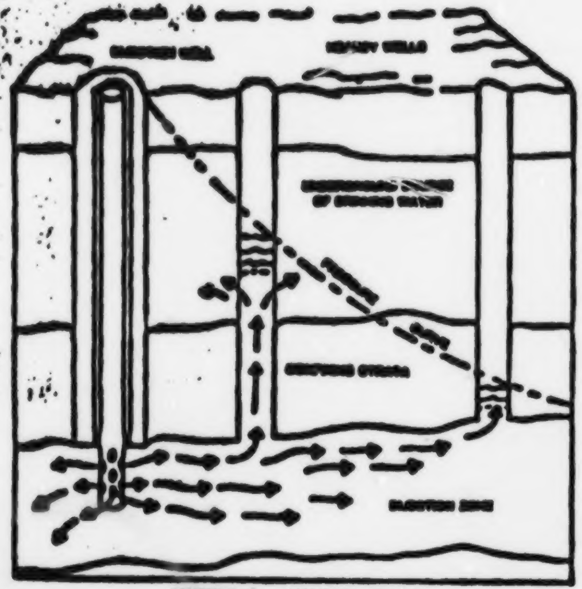


FIGURE 2. NEARBY WELLS

3. Faulty or Fractured Confining St

Fluids may be forced upward out the pressurized area through faults o fractures in the confining beds, as illustrated in Figure 3.

Preventive Requirements

Wells must generally be sited so that they inject below a confining be that is free of known open faults or fractures. Injection pressure must b controlled so that fractures are not enlarged in the injection zone or cre in the confining bed.

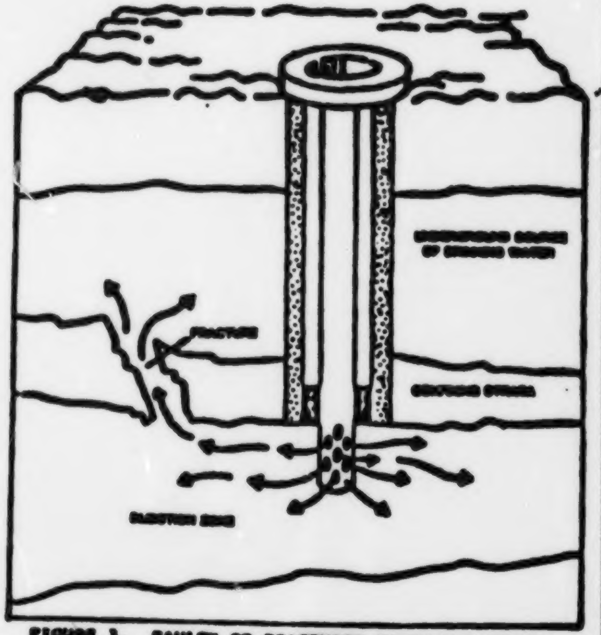


FIGURE 3. FAULTY OR FRACTURED CONFINING STRATA

4. Direct Injection

Wells may be designed to inject into or above underground sources of drinking water, as illustrated in Figure 4.

Preventive Requirement

Wells injecting hazardous waste materials or radioactive waste into underground sources of drinking water are illegal. However, wells injecting hazardous wastes or radioactive wastes into exempted aquifers will not be banned. Wells that inject nonhazardous material will be regulated in the future based on recommendations to be formulated by the states.

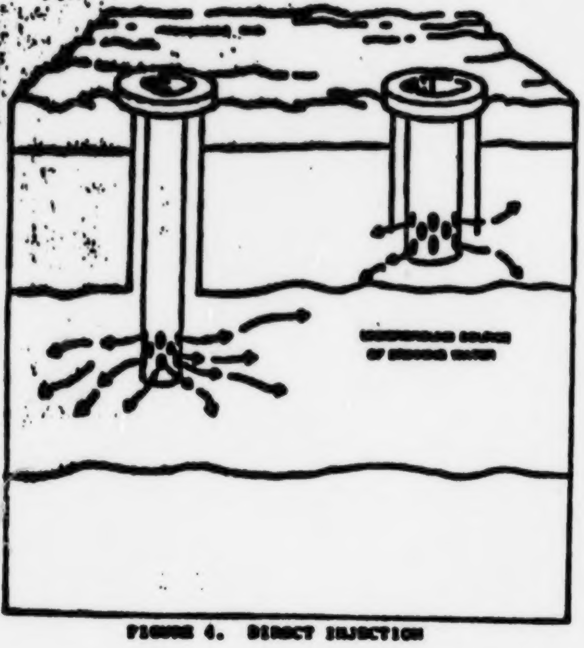


FIGURE 4. DIRECT INJECTION

5. Lateral Displacement

Fluid may be displaced from the injection zone into hydraulically connected underground sources of drinking water, as illustrated in Figure 5.

Preventive Requirement

The proximity of injection wells to underground sources of drinking water will be considered in future siting of such wells. Well operators will be required to control injection pressure and conduct other monitoring activities to prevent the lateral migration of fluids illustrated in Figure 5.

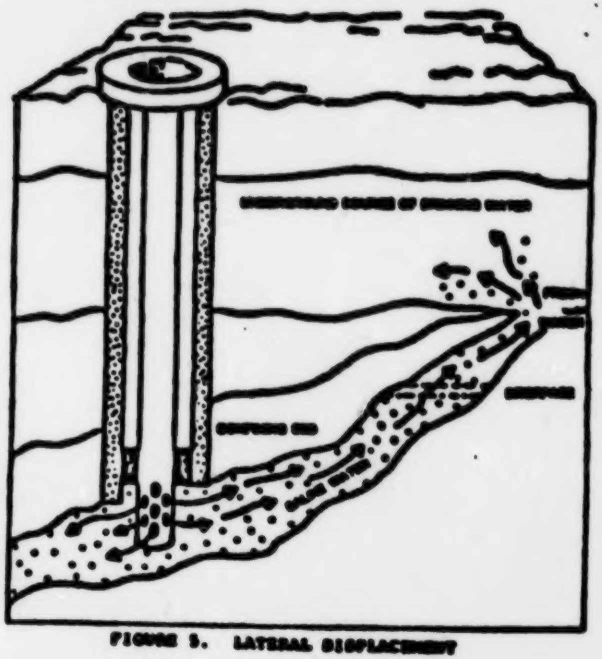


FIGURE 5. LATERAL DISPLACEMENT

Requirements for Injection Well Classes

To implement its proposed technological controls, EPA categorized well injection activities into five classes defined in Figure 6. Each class includes wells with similar functions and construction and operating features so that technical requirements can be applied consistently to the class. A brief summary of the general underground injection controls proposed for each class are highlighted in Figure 7.

FIGURE 6

FIVE CLASSES OF INJECTION WELLS

- Class I wells are those used to inject industrial, hazardous and municipal wastes beneath the deepest stratum containing an underground drinking water source.
- Class II wells are used to dispose of fluids which are brought to the surface in connection with oil and gas production, to inject fluids for the enhanced recovery of oil or gas, or to store liquid hydrocarbons.
- Class III wells are those used to inject fluids for the extraction of minerals.
- Class IV wells are those for which hazardous waste or radioactive waste are injected into or above strata that contain underground drinking water sources and those wells which inject hazardous wastes or radioactive wastes into exempted aquifers.
- Class V wells include all wells not incorporated in Classes I-IV. Typical examples of such wells are recharge wells and air conditioning return flow wells.

FIGURE 7

TYPE OF CONTROLS APPLICABLE TO INJECTION WELL CLASSES

TYPE OF CONTROL	CLASS I	CLASS II	CLASS III	CLASS IV
AREA OF REVIEW	Yes	New Wells Only	Yes	N/A
MECHANICAL INTEGRITY REQUIREMENTS	Yes	Yes	Yes	N/A
CONSTRUCTION REQUIREMENTS	Strict	Flexible	Moderate	Normal
MONITORING	Continuous	Periodic	Continuous	Varied
REPORTING	Quarterly	Annual	Quarterly	Quarterly
FORM OF REGULATION	By Permit	By Rule or Permit	By Permit	By Rule

Class I

Class I wells are likely to inject potentially dangerous fluids, and will, therefore, have to meet strict construction and operating requirements.

Class I wells must inject into strata that are below the deepest underground source of drinking water and must have an adequate confining layer above the injection zone. All Class I wells must be cased and cemented to prevent fluid migration and must inject through tubing with a suitable packer set immediately above the injection zone (or an equivalent alternative).

Mechanical integrity must be demonstrated upon completion of the well and every five years thereafter, and corrective action must be taken on improperly plugged or completed wells within the area of review.

Class I well operators are required to monitor continuously the volume of disposal wastes, and well annular pressures. Class I operators must also test the composition of injected fluids periodically and provide the permitting authority with quarterly operating reports.

Sixteen Class I wells are known to exist in Indiana.

Class II

Requirements for Class II wells (those injection wells associated with oil and gas production) have been fashioned in light of the congressional mandate that the UIC regulations are not to interfere with or impede oil and gas production unless necessary to protect underground drinking water sources.

These regulations attempt to balance measures necessary for the protection of the environment against burdens imposed on the regulated community.

Class II injection wells are to have casing and cementing adequate to protect underground sources of drinking water. All Class II wells will also have to demonstrate mechanical integrity initially and every five years thereafter. However, only the applicants for new Class II permits must review nearby wells in the area of review and take corrective action on those improperly completed or plugged wells.

Operators of Class II wells are subject to limitations on the pressure and rate of injection. They must also monitor the injection pressure and volume, and the quality of the injection fluids at intervals depending on the type of operation. Annual reports to the permitting authority are required.

Two thousand, three hundred and sixty Class II wells are known to exist in Indiana.

Class III

Construction, monitoring, and reporting requirements for these wells will resemble those for Class I wells. Class III wells must be cased and cemented to prevent fluid migration. All Class III wells must comply with area of review requirements and demonstrate mechanical integrity. Class III wells will have the same monitoring requirements as Class I wells, except that more frequent monitoring will be required of drinking water supply wells adjacent to the injection sites.

No Class III wells are known to exist in Indiana.

Class IV

Existing Class IV wells used by generators of hazardous waste and radioactive waste and operators of hazardous waste management facilities which inject directly into an underground source of drinking water will be closed as soon as possible, but in no event later than six months from the effective date of the program. No new Class IV wells which inject directly into or above an underground source of drinking water will be authorized or permitted. EPA considers these wells to be a significant danger to underground drinking water sources. However, Class IV wells injecting into exempted aquifers will not be banned. EPA requirements for Class IV wells which inject above underground sources of drinking water have not been established.

Operators of Class IV wells will be required to monitor injected fluid characteristics and volumes, as required for hazardous wastes under the Resource Conservation and Recovery Act. Weekly monitoring of the impact of injections on drinking water supply wells will also be necessary. Class IV well operators must submit quarterly reports of operating results and immediate reports of changes in the characteristics of water supply wells in the vicinity of Class IV wells.

No Class IV wells are known to exist in Indiana.

Class V

At present EPA has too little information on the extent, operation, and impact of Class V wells to propose a suitable regulatory approach. The regulations, therefore, require an

inventory and an assessment of such wells in each state. Specific regulatory requirements will be fashioned after the completion of the assessments.

EPA will take immediate action on any Class V well that poses a significant risk to human health.

Between sixty and one hundred and fifty Class V wells are known to exist in Indiana.

III. PERMITS AND RULES - TOOLS FOR REGULATION

Under the Act, EPA has the discretion to specify whether the minimum national requirements are to be applied through rules or permits. A rule is a law, ordinance or regulation that sets forth the standards and conditions under which an activity may be conducted. A permit is a specific authorization to an individual to carry on an activity under the conditions and limitations specified in the permit.

Each method of control is appropriate in certain situations. Although the requirements imposed are equally enforceable under either method, permits are generally considered to make possible a greater degree of control. On the other hand, permits need more time and resources since they require: (1) the individual to file an application containing information about his proposed activity; (2) the effective participation of the public in the review process; and (3) EPA personnel to review, write and process each permit.

Who Must Obtain a Permit

Owners/operators of Class I, Class II (except existing enhanced recovery and existing liquid hydrocarbon storage), and Class III wells must obtain a permit to inject. New wells (those that begin to inject after the effective date of a program in a state) must be authorized by a permit before injection may begin. For existing wells, the permitting authority (EPA) will develop a schedule not to exceed five years, based on appropriate priorities, for issuing or reissuing the permits. Until the application of the owner/operator of an existing well has been processed, the injection may be authorized by rule.

A permit may be sought either for an individual well or for a group of wells in an area. An area permit may be issued for a group of wells if they are:

- Used to inject other than hazardous waste.
- Under the control of a single individual.
- Within a single field, project or site within a state.
- Of the same type and construction.
- Injecting into the same aquifer or zone.

Under an area permit, additional wells that meet the above criteria may be authorized administratively by the permitting authority.

Who May Be Authorized By Rule

Class II existing enhanced recovery and existing liquid hydrocarbon storage wells, may be authorized by rule for the

life of the well. New Class IV wells injecting into or above underground sources of drinking water are banned. Existing Class IV wells injecting into underground sources of drinking water may be authorized by rule until they are closed but in no case for more than six months after the effective date of the program. Class V wells may be authorized by rule until such a time as further regulations are issued by EPA. All of these rules must apply the requirements specified for the appropriate well class in the UIC regulations.

As mentioned above, owners/operators of existing wells waiting to file their applications and have them processed may be authorized to inject by rule in the interim. Such rules must incorporate the appropriate monitoring, reporting and abandonment requirements for each well class.

Finally, in the case of imminent and substantial hazard to human health or the environment, or if substantial and irretrievable loss of oil and gas resources will occur, injection not otherwise authorized may be desirable. In such cases, a temporary authorization to inject may be granted administratively, subject to certain limitations.

Basic Permit Requirements

Class I and Class V permits may be issued for up to ten years. Class II and Class III wells may be issued for the life of the well. However, each Class II and Class III permit will be reviewed at least once every five years. Duration of Class IV permits have not yet been established.

Each permit must be enforceable in the jurisdiction in which it is issued. It must specify construction, abandonment, operating, monitoring and reporting requirements appropriate to the well class. In addition, permits must incorporate appropriate compliance schedules if any corrective action is to be taken by the well owner/operator. Finally, permits must authorize the right of the permitting authority to have access to the well and the related records to assure compliance with permit terms.

How to Obtain a Permit

Applications for new injection wells should be filed with EPA in time to allow for the review and issuance of the permit prior to construction. Applications for existing wells will be filed according to the schedule established in each state, but in no case later than four years after the effective date of the program.

UIC permits for Indiana will be issued by EPA Region V headquarters in Chicago (see Appendix A). Permit applications must be signed by a policy level officer of the company except in the case of Class II wells where applications may be made by individuals authorized by their companies in writing to do so. Applications must contain a statement that the signing official has satisfied himself that the information provided is correct.

The information that must be available to EPA is specified for each well class in CFR Part 146. Generally, such information should include the surface and subterranean features of the injection area, the location of underground sources of drinking water in the vicinity, the results of tests in the proposed injection formation, construction features of the well, and the nature of the proposed injection operation. Contact with EPA should be made early in the project to obtain the necessary forms and information. EPA can also provide guidance on appropriate sources of information necessary to complete the application.

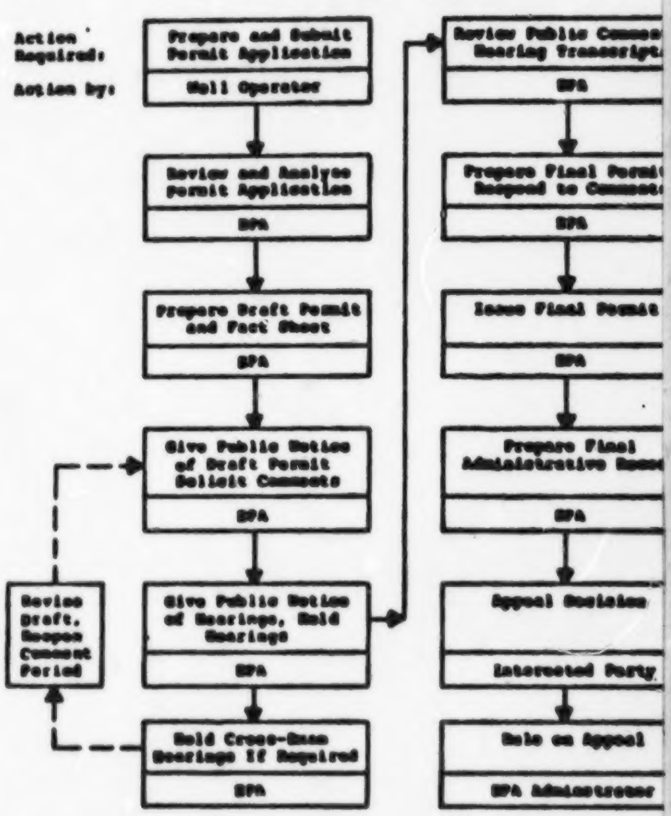
The review of a permit application begins with the receipt of a complete application by EPA. The EPA considers the application, gathers such additional information as it needs, and prepares a draft permit. The draft permit must be presented for public comment for at least 30 days with a fact sheet that provides enough information that the public can make informed judgments about the proposed action. If there is sufficient interest, a public hearing will be held and announced at least 30 days in advance.

Public comments must be taken into account in preparing the final permit, and the EPA will prepare a summary of the comments and its responses to them. A final permit is then prepared and issued. Figure 8 presents a schematic summary of the process.

First, EPA will also prepare an administrative record that documents its decision making for both the draft and final permit. Second, if sufficient interest is expressed, EPA may, after a public hearing, hold a further hearing with an opportunity for cross examination. Third, if sufficient new information becomes available during the public comment period, EPA may prepare a revised draft permit and solicit further public comment. A final EPA permit does not become effective for 30 days after it is issued. During that time, a permit may be appealed. Appeals will be considered in an established EPA process.

FIGURE 8

THE UIC PERMIT PROCESS


Action Required:
Action by:
Prepare and Submit Permit Application
Well Operator
Review and Analyze Permit Application
EPA
Prepare Draft Permit and Fact Sheet
EPA
Give Public Notice of Draft Permit Solicit Comments
EPA
Give Public Notice of Hearings, Hold Hearings
EPA
Hold Cross-Exam Hearings If Required
EPA
Revise Draft, Reopen Comment Period
Review Public Comme
Hearing Transcript
EPA
Prepare Final Permit
Respond to Comment
EPA
Issue Final Permit
EPA
Prepare Final
Administrative Reco
EPA
Appeal Decision
Interested Party
Rule on Appeal
EPA Administrator

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IV. STATE INVOLVEMENT IN UNDERGROUN INJECTION CONTROL

The Safe Drinking Water Act clear intends the states to have the primary responsibility (primacy) for developin and implementing UIC programs. In fashioning these regulations, EPA has attempted to encourage states to assum primary responsibility (primacy).

Primacy states must have the auth ity to regulate injection wells at Federal facilities within the state. Injection on Indian lands, however, wi remain a Federal responsibility if the state does not have adequate authority

The State of Indiana has not submitted an approvable UIC program to EP Therefore, the Safe Drinking Water Act mandates EPA to establish and run a UI program in Indiana. The Indiana Strea Pollution Control Board, in conjunctio with the Indiana State Board of Health and the Department of Natural Resource through state law, conduct regulatory programs similar to the EPA UIC progra The Indiana Stream Pollution Control Board regulates all discharges to grou water (except those related to oil and gas production) by the issuance of construction, operation and discharge permits. The discharge permitting program is administered by the Indiana State Board of Health through the divisions of Water Pollution Control, Land Pollution Control, Sanitary Engineerin and the Public Water Supply Section. All injection, disposal and enhanced recovery wells associated with oil and gas production are regulated by the Indiana Department of Natural Resources which requires all drillers to be licensed. Injection well operators must currently comply with both state and EPA requirements although Indiana has the option of pursuing primacy for UIC at any time in the future.

V. EPA's UIC PROGRAM FOR INDIANA

All owners and operators in the State of Indiana are required to comply with the UIC regulations listed in 40 CFR Parts 124, 144 and 146 in addition to the Part 147 regulations that pertain to the particular combination of historical practices and geology unique to Indiana.

Maximum injection pressure for the State of Indiana for wells authorised by rule is calculated by the use of a simple formula, based on a fracture gradient measured in psi/ft., to assure that operations do not initiate or propogate fractures in the injection zone. A fracture gradient of 0.8 psi/ft. will be used for Indiana. Owners or operators may apply for and receive permission to operate at greater pressures by applying for a permit and demonstrating that they will not endanger a USDW.

Due to the large number of wells involved, the area of review for Class II wells will be based on a fixed radius in order to avoid considerable delay in program implementation caused by processing requests based on many formulae.

All Class I through Class V wells, with the exception of Class II wells, associated with oil and gas production, are currently regulated by the Indiana State Board of Health in conjunction with the Indiana Stream Pollution Control

Board (SPCB). Class II wells associated with oil and gas production are regulated by the Department of Natural Resources. In addition, with promulgation of the federal program, all injection wells must comply with the Federal UIC regulations.

MATRIX OF INDIANA STATE AGENCY AUTHORITY

STATE AGENCY	STREAM POLLUTION CONTROL BOARD	INDIANA BOARD OF HEALTH	DEPARTM NATURAL R
CLASS I			
MUNICIPAL	X	X	
INDUSTRIAL	X	X	
HAZARDOUS	X	X	
CLASS II			
STORAGE WELL			X
SALT WATER DISPOSAL			X
ENHANCED RECOVERY			X
CLASS III	X	X	
CLASS IV	X	X	
CLASS V			
AIR CONDITIONING RETURN	N		
CESSPOOLS/SEPTIC SYSTEMS	X	X	
URBAN RUNOFF WELLS	N		
DRY WELLS	Y		
RECHARGE WELLS	Y		
SALT WATER BARRIER WELLS	Y		
SAND BACKFILL	Y		
SUBSIDENCE CONTROL	Y		
RADIOACTIVE WASTE	Y		
GEOTHERMAL WELLS	Y		
IN SITU GASIFICATION	Y		

X = STATE AGENCY AUTH

N = NOT REGULATED

Y = NOT KNOWN TO EXIST I
STATE OF INDIANA

APPENDIX A

LIST OF CONTACTS REGARDING UNDERGROUND INJECTION IN INDIANA BY WELL CLASS

EPA Region V
Ground Water Protection Branch (SWD-12)
230 South Dearborn
Chicago, IL 60604
Mark Vendl (312) 886-6195

Class I:

Indiana Stream Pollution Control Board
1330 West Michigan Street
Indianapolis, IN 46206
Virgil Bradford (317) 633-0700

Indiana State Board of Health
1330 West Michigan Street
Water Pollution Control Division
Indianapolis, IN 46206
Larry Kane (317) 633-0761

Class II:

Indiana Stream Pollution Control Board
1330 West Michigan Street
Indianapolis, IN 46206
Virgil Bradford (317) 633-0700

Indiana State Board of Health
1330 West Michigan Street
Water Pollution Control Division
Indianapolis, IN 46206
Larry Kane (317) 633-0761

Class II: Associated with oil and gas production.

Indiana Department of Natural Resources
911 State Office Building
Indianapolis, IN 46204
Homer Brown (317) 232-4055

Class III:

Indiana Stream Pollution Control Board
1330 West Michigan Street
Indianapolis, IN 46206
Virgil Bradford (317) 633-0700

Indiana State Board of Health
1330 West Michigan Street
Water Pollution Control Division
Indianapolis, IN 46206
Larry Kane (317) 633-0761

Class IV:

Indiana Stream Pollution Control Board
1330 West Michigan Street
Indianapolis, IN 46206
Virgil Bradford (317) 633-0700

Indiana State Board of Health
1330 West Michigan Street
Water Pollution Control Division
Indianapolis, IN 46206
Larry Kane (317) 633-0761

Class V:

Indiana Stream Pollution Control Board
1330 West Michigan Street
Indianapolis, IN 46206
Virgil Bradford (317) 633-0700

Indiana State Board of Health
1330 West Michigan Street
Water Pollution Control Division
Indianapolis, IN 46206
Larry Kane (317) 633-0761

ATTACHMENT E

Extraction Protocol
Waste Treatment Results for Inorganics

This attachment tabulates the data used to develop the conclusions in the report for chemical extraction and soil washing and immobilization of inorganics. The influent and effluent extraction protocol concentrations in the wastes are reported, as well as the corresponding reductions in mobility. The data are sorted by treatability group, technology group, and contaminant. Not all treatability groups have data for all technology groups.

ATTACHMENT E

BDAT FOR CONTAMINATED SOIL
Ranked by Reduction in Mobility
For Individual Treatment Technologies
Influent Extract - Effluent Extract

Page: 1
Date: 01/08/1989

Treatability Group: W10 NON-VOLATILE METALS
Process Group: CHEMICAL EXTRACTION AND SOIL WASHING

nk	Mobility Reduction	Influent Concen (PPM)	Qul Inf	Effluent Concen (PPM)	Qul Eff	Process Description	Contaminant Name	Media	Scale	Document Number	Test Num
1	0.9899312	159.90000		1.61000		SOIL WASHING	COPPER	SOIL	B	ORD-TSI-RT-EUQW-1	52
2	0.9878674	159.90000		1.94000		SOIL WASHING	COPPER	SOIL	R	ORD-TSI-RT-EUQW-1	58
3	0.9857497	80.70000		1.15000		SOIL WASHING	COPPER	SOIL	B	ORD-TSI-RT-EUQW-1	40
4	0.9836431	80.70000		1.32000		SOIL WASHING	COPPER	SOIL	R	ORD-TSI-RT-EUQW-1	34
5	0.9827757	80.70000		1.39000		SOIL WASHING	COPPER	SOIL	R	ORD-TSI-RT-EUQW-1	41
6	0.9811757	159.90000		3.01000		SOIL WASHING	COPPER	SOIL	R	ORD-TSI-RT-EUQW-1	46
7	0.9630597	26.80000		0.99000		SOIL WASHING	NICKEL	SOIL	R	ORD-TSI-RT-EUQW-1	52
8	0.9604477	26.80000		1.06000		SOIL WASHING	NICKEL	SOIL	B	ORD-TSI-RT-EUQW-1	58
9	0.9550500	0.89000		0.04000		SOIL WASHING	COPPER	SOIL	R	ORD-TSI-RT-EUQW-1	16
10	0.9541045	26.80000		1.23000		SOIL WASHING	NICKEL	SOIL	R	ORD-TSI-RT-EUQW-1	46
11	0.9462857	17.50000		0.94000		SOIL WASHING	NICKEL	SOIL	B	ORD-TSI-RT-EUQW-1	41
12	0.9438200	0.89000		0.05000		SOIL WASHING	COPPER	SOIL	B	ORD-TSI-RT-EUQW-1	28
13	0.9382114	159.90000		9.80000		SOIL WASHING	COPPER	SOIL	[illegible]	ORD-TSI-RT-EUQW-1	53
14	0.9344200	0.61000		0.04000		SOIL WASHING	COPPER	SOIL	B	ORD-TSI-RT-EUQW-1	4
15	0.9280000	17.50000		1.26000		SOIL WASHING	NICKEL	SOIL	B	ORD-TSI-RT-EUQW-1	34
16	0.9245714	17.50000		1.32000		SOIL WASHING	NICKEL	SOIL	B	ORD-TSI-RT-EUQW-1	40
17	0.9208178	80.70000		6.39000		SOIL WASHING	COPPER	SOIL	B	ORD-TSI-RT-EUQW-1	35
18	0.9108571	17.50000		1.56000		SOIL WASHING	NICKEL	SOIL	B	ORD-TSI-RT-EUQW-1	35
19	0.9059701	26.80000		2.52000		SOIL WASHING	NICKEL	SOIL	B	ORD-TSI-RT-EUQW-1	53
20	0.9016400	0.61000		0.06000		SOIL WASHING	COPPER	SOIL	B	ORD-TSI-RT-EUQW-1	10
21	0.9000000	0.40000		0.04000		SOIL WASHING	NICKEL	SOIL	B	ORD-TSI-RT-EUQW-1	22
22	0.8876400	0.89000		0.10000		SOIL WASHING	COPPER	SOIL	R	ORD-TSI-RT-EUQW-1	22
23	0.8876400	0.89000		0.10000		SOIL WASHING	COPPER	SOIL	R	ORD-TSI-RT-EUQW-1	23
24	0.8518500	0.27000		0.04000		SOIL WASHING	NICKEL	SOIL	R	ORD-TSI-RT-EUQW-1	4
25	0.8518500	0.27000		0.04000		SOIL WASHING	NICKEL	SOIL	R	ORD-TSI-RT-EUQW-1	10
26	0.8333000	0.06000		0.01000		SOIL WASHING	CHROMIUM	SOIL	R	ORD-TSI-RT-EUQW-1	46
27	0.8333000	0.06000		0.01000		SOIL WASHING	CHROMIUM	SOIL	R	ORD-TSI-RT-EUQW-1	52
28	0.8333000	0.06000		0.01000		SOIL WASHING	CHROMIUM	SOIL	B	ORD-TSI-RT-EUQW-1	53
29	0.8333000	0.06000		0.01000		SOIL WASHING	CHROMIUM	SOIL	R	ORD-TSI-RT-EUQW-1	58
30	0.7777000	0.27000		0.06000		SOIL WASHING	NICKEL	SOIL	B	ORD-TSI-RT-EUQW-1	11
31	0.7250000	0.40000		0.11000		SOIL WASHING	NICKEL	SOIL	B	ORD-TSI-RT-EUQW-1	23
32	0.7049200	0.61000		0.18000		SOIL WASHING	COPPER	SOIL	R	ORD-TSI-RT-EUQW-1	11
33	0.7000000	0.40000		0.12000		SOIL WASHING	NICKEL	SOIL	R	ORD-TSI-RT-EUQW-1	28
34	0.6250000	0.40000		0.15000		SOIL WASHING	NICKEL	SOIL	R	ORD-TSI-RT-EUQW-1	16

SOIL - 34 data points SLUDGE (SLUD) - 0 data points

ATTACHMENT E

BDAT FOR CONTAMINATED SOIL
Ranked by Reduction in Mobility
For Individual Treatment Technologies
Influent Extract Effluent Extract

Page: 2
Date: 01/08/1989

Treatability Group: W10 NON-VOLATILE METALS
Process Group: IMMOBILIZATION

Rnk	Mobility Reduction	Influent Concen (PPM)	Qul Inf	Effluent Concen (PPM)	Qul Eff	Process Description	Contaminant Name	Media	Scale	Document Number	Test Run
1	0.4400000	1.00000		0.56000		STABILIZATION	CHROMIUM	SOIL	B	9RO-TSI-RT-FCAK-1	1
2	0.2500000	1.00000		0.75000		STABILIZATION	CHROMIUM	SOIL	B	9RO-TSI-RT-FCAK-1	1
3	0.2000000	1.00000		0.80000		STABILIZATION	CHROMIUM	SOIL	B	9RO-TSI-PT-FCAK-1	1
4	0.0700000	1.00000		0.93000		STABILIZATION	CHROMIUM	SOIL	B	9RO-TSI-RT-FCAK-1	1

SOIL - 4 data points SLUDGE (SLUD) - 0 data points

Rnk	Mobility Reduction	Influent Concen (PPM)	Qul Inf	Effluent Concen (PPM)	Qul Eff	Process Description	Contaminant Name	Media	Scale	Document Number	Test Run
1	0.9016400	0.61000		0.06000		CEMENT SOLIDIFICATIO	COPPER	SOIL	B	ORD-TSI-RT-FHMF-1	1
2	0.8593400	0.22750		0.03200		CEMENT SOLIDIFICATIO	COPPER	SOIL	B	9RO-TSI-RT-EUXT-1	1
3	0.8518500	0.27000		0.04000		CEMENT SOLIDIFICATIO	NICKEL	SOIL	B	ORD-TSI-RT-FHMF-1	1
4	0.3000000	0.05000		0.03500		CEMENT SOLIDIFICATIO	CHROMIUM	SOIL	B	9RO-TSI-RT-EUXT-1	1

SOIL - 4 data points SLUDGE (SLUD) - 0 data points

Rnk	Mobility Reduction	Influent Concen (PPM)	Qul Inf	Effluent Concen (PPM)	Qul Eff	Process Description	Contaminant Name	Media	Scale	Document Number	Test Run
1	0.9998850	87.00000		0.01000	ND	FLYASH SOLIDIFICATIO	NICKEL	SLUD	P	9RO-TSI-RT-FAAP-1	1
2	0.9998850	87.00000		0.01000	ND	FLYASH SOLIDIFICATIO	NICKEL	SLUD	P	9RO-TSI-RT-FAAP-1	1
3	0.9998684	76.00000		0.01000	ND	FLYASH SOLIDIFICATIO	NICKEL	SLUD	P	9RO-TSI-RT-FAAP-1	2
4	0.9990909	22.00000		0.02000		FLYASH SOLIDIFICATIO	CHROMIUM	SLUD	P	9RO-TSI-RT-FAAP-1	1
5	0.9986363	22.00000		0.03000		FLYASH SOLIDIFICATIO	CHROMIUM	SLUD	P	9RO-TSI-RT-FAAP-1	1
6	0.9985074	26.80000		0.04000		FLYASH SOLIDIFICATIO	NICKEL	SOIL	B	ORD-TSI-RT-FHMF-1	2
7	0.9980263	76.00000		0.15000		FLYASH SOLIDIFICATIO	NICKEL	SLUD	P	9RO-TSI-RT-FAAP-1	2
8	0.9895560	159.90000		1.67000		FLYASH SOLIDIFICATIO	COPPER	SOIL	B	ORD-TSI-RT-FHMF-1	2
9	0.9800000	3.50000		0.07000		FLYASH SOLIDIFICATIO	CHROMIUM	SLUD	P	9RO-TSI-RT-FAAP-1	2
10	0.9800000	3.50000		0.07000		FLYASH SOLIDIFICATIO	CHROMIUM	SLUD	P	9RO-TSI-RT-FAAP-1	2
11	0.9662900	0.89000		0.03000		FLYASH SOLIDIFICATIO	COPPER	SOIL	B	ORD-TSI-RT-FHMF-1	5
12	0.9000000	0.40000		0.04000		FLYASH SOLIDIFICATIO	NICKEL	SOIL	B	ORD-TSI-RT-FHMF-1	4
13	0.9000000	0.40000		0.04000		FLYASH SOLIDIFICATIO	NICKEL	SOIL	B	ORD-TSI-RT-FHMF-1	5
14	0.8988700	0.89000		0.09000		FLYASH SOLIDIFICATIO	COPPER	SOIL	B	ORD-TSI-RT-FHMF-1	4

SOIL - 6 data points SLUDGE (SLUD) - 8 data points

Rnk	Mobility Reduction	Influent Concen (PPM)	Qul Inf	Effluent Concen (PPM)	Qul Eff	Process Description	Contaminant Name	Media	Scale	Document Number	Test Run
1	0.9971420	17.50000		0.05000		CARBONATE IMMOBILIZA	NICKEL	SOIL	B	ORD-TSI-RT-FHMF-1	3
2	0.9679058	80.70000		2.59000		CARBONATE IMMOBILIZA	COPPER	SOIL	B	ORD-TSI RT-FHMF-1	1

SOIL - 2 data points SLUDGE (SLUD) - 0 data points

ATTACHMENT E

BDAT FOR CONTAMINATED SOIL
Ranked by Reduction in Mobility
For Individual Treatment Technologies
Influent Extract - Effluent Extract

Page: 1
Date: 03/08/1989

Treatability Group: W11 VOLATILE METALS
Process Group: CHEMICAL EXTRACTION AND SOIL WASHING

Rnk	Mobility Reduction	Influent Concen (PPM)	Qul Inf	Effluent Concen (PPM)	Qul Eff	Process Description	Contaminant Name	Media	Scale	Document Number	Test Num
1	0.9950284	70.40000		0.35000		SOIL WASHING	LEAD	SOIL	B	ORD-TSI-RT-EUQW-1	46
2	0.9943182	70.40000		0.40000		SOIL WASHING	LEAD	SOIL	B	ORD-TSI-RT-EUQW-1	52
3	0.9928977	70.40000		0.50000		SOIL WASHING	LEAD	SOIL	B	ORD-TSI-RT-EUQW-1	50
4	0.9924657	14.60000		0.11000		SOIL WASHING	ZINC	SOIL	B	ORD-TSI-RT-EUQW-1	28
5	0.9712329	14.60000		0.42000		SOIL WASHING	ZINC	SOIL	B	ORD-TSI-RT-EUQW-1	22
6	0.9678082	14.60000		0.47000		SOIL WASHING	ZINC	SOIL	B	ORD-TSI-RT-EUQW-1	16
7	0.9589000	0.73000		0.03000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TSI-RT-EUQW-1	28
8	0.9541076	35.30000		1.62000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TSI-RT-EUQW-1	52
9	0.9486301	14.60000		0.75000		SOIL WASHING	ZINC	SOIL	B	ORD-TSI-RT-EUQW-1	23
10	0.9350453	33.10000		2.15000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TSI-RT-EUQW-1	41
11	0.9348011	70.40000		4.59000		SOIL WASHING	LEAD	SOIL	B	ORD-TSI-RT-EUQW-1	53
12	0.9315000	0.73000		0.05000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TSI-RT-EUQW-1	22
13	0.9315000	0.73000		0.05000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TSI-RT-EUQW-1	23
14	0.9252441	358.50000		26.80000		SOIL WASHING	ZINC	SOIL	B	ORD-TSI-RT-EUQW-1	41
15	0.9217120	9.58000		0.75000		SOIL WASHING	ARSENIC	SOIL	B	ORD-TSI-RT-EUQW-1	52
16	0.9216080	19.90000		1.56000		SOIL WASHING	LEAD	SOIL	B	ORD-TSI-RT-EUQW-1	41
17	0.9155807	35.30000		2.98000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TSI-RT-EUQW-1	46
18	0.9142800	0.70000		0.06000		SOIL WASHING	LEAD	SOIL	B	ORD-TSI-RT-EUQW-1	16
19	0.9139280	6.39000		0.55000		SOIL WASHING	ARSENIC	SOIL	B	ORD-TSI-RT-EUQW-1	41
20	0.9076080	9.20000		0.85000		SOIL WASHING	ZINC	SOIL	B	ORD-TSI-RT-EUQW-1	10
21	0.9043480	9.20000		0.88000		SOIL WASHING	ZINC	SOIL	B	ORD-TSI-RT-EUQW-1	4
22	0.9041100	0.73000		0.07000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TSI-RT-EUQW-1	16
23	0.9021740	9.20000		0.90000		SOIL WASHING	ZINC	SOIL	B	ORD-TSI-RT-EUQW-1	11
24	0.9018790	9.58000		0.94000		SOIL WASHING	ARSENIC	SOIL	B	ORD-TSI-RT-EUQW-1	46
25	0.8998430	6.39000		0.64000		SOIL WASHING	ARSENIC	SOIL	B	ORD-TSI-RT-EUQW-1	40
26	0.8987470	9.58000		0.97000		SOIL WASHING	ARSENIC	SOIL	B	ORD-TSI-RT-EUQW-1	50
27	0.8964385	395.90000		41.00000		SOIL WASHING	ZINC	SOIL	B	ORD-TSI-RT-EUQW-1	52
28	0.8926497	395.90000		42.50000		SOIL WASHING	ZINC	SOIL	B	ORD-TSI-RT-EUQW-1	50
29	0.8891238	33.10000		3.67000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TSI-RT-EUQW-1	40
30	0.8711297	358.50000		46.20000		SOIL WASHING	ZINC	SOIL	B	ORD-TSI-RT-EUQW-1	40
31	0.8654150	6.39000		0.86000		SOIL WASHING	ARSENIC	SOIL	B	ORD-TSI-RT-EUQW-1	34
32	0.8620396	35.30000		4.87000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TSI-RT-EUQW-1	50
33	0.8605300	358.50000		50.00000		SOIL WASHING	ZINC	SOIL	B	ORD-TSI-RT-EUQW-1	34
34	0.8524407	358.50000		52.90000		SOIL WASHING	ZINC	SOIL	B	ORD-TSI-RT-EUQW-1	35
35	0.8504532	33.10000		4.95000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TSI-RT-EUQW-1	34
36	0.8430595	35.30000		5.54000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TSI-RT-EUQW-1	53
37	0.8006260	9.58000		1.91000		SOIL WASHING	ARSENIC	SOIL	B	ORD-TSI-RT-EUQW-1	51
38	0.8002021	395.90000		79.10000		SOIL WASHING	ZINC	SOIL	B	ORD-TSI-RT-EUQW-1	46
39	0.7857100	0.70000		0.15000		SOIL WASHING	LEAD	SOIL	B	ORD-TSI-RT-EUQW-1	22
40	0.7857100	0.70000		0.15000		SOIL WASHING	LEAD	SOIL	B	ORD-TSI-RT-EUQW-1	23
41	0.7857100	0.70000		0.15000		SOIL WASHING	LEAD	SOIL	B	ORD-TSI-RT-EUQW-1	28

ATTACHMENT E

BDAT FOR CONTAMINATED SOIL
Ranked by Reduction in Mobility
For Individual Treatment Technologies
Influent Extract Effluent Extract

Page: 4
Date: 03/08/1989

Treatability Group: W11 VOLATILE METALS
Process Group: CHEMICAL EXTRACTION AND SOIL WASHING

Rnk	Mobility Reduction	Influent Concen (PPM)	Qul Inf	Effluent Concen (PPM)	Qul Eff	Process Description	Contaminant Name	Media	Scale	Document Number	Test Num
42	0.7735800	0.53000		0.12000		SOIL WASHING	CADMIUM	SOIL	B	OPD-TSI-RT-EUQN-1	16
43	0.7646525	33.10000		7.79000		SOIL WASHING	CADMIUM	SOIL	B	OPD-TSI-RT-EUQN-1	35
44	0.7351759	19.90000		5.27000		SOIL WASHING	LEAD	SOIL	B	OPD-TSI-RT-EUQN-1	40
45	0.7261340	6.39000		1.75000		SOIL WASHING	ARSENIC	SOIL	B	OPD-TSI-PT-EUQN-1	35
46	0.7169800	0.53000		0.15000		SOIL WASHING	CADMIUM	SOIL	B	OPD-TSI-PT-EUQN-1	4
47	0.6938800	0.49000		0.15000		SOIL WASHING	LEAD	SOIL	B	OPD-TSI-PT-EUQN-1	4
48	0.6938800	0.49000		0.15000		SOIL WASHING	LEAD	SOIL	B	OPD-TSI-PT-EUQN-1	10
49	0.6938800	0.49000		0.15000		SOIL WASHING	LEAD	SOIL	B	OPD-TSI-PT-EUQN-1	11
50	0.6753769	19.90000		6.46000		SOIL WASHING	LEAD	SOIL	B	OPD-TSI-PT-EUQN-1	34
51	0.6666600	0.15000		0.05000		SOIL WASHING	ARSENIC	SOIL	B	OPD-TSI-PT-EUQN-1	10
52	0.6542056	395.90000		136.90000		SOIL WASHING	ZINC	SOIL	B	OPD-TSI-PT-EUQN-1	53
53	0.5094300	0.53000		0.26000		SOIL WASHING	CADMIUM	SOIL	B	OPD-TSI-RT-EUQN-1	11
54	0.4135678	19.90000		11.67000		SOIL WASHING	LEAD	SOIL	B	OPD-TSI-PT-EUQN-1	35

SOIL - 54 data points SLUDGE (SLUD) - 0 data points

'reatability Group: W11 VOLATILE METALS
'rocess Group: IMMOBILIZATION

[illegible] Effluent Extract

nk	Mobility Reduction	Influent Concen (PPM)	Qul Inf	Effluent Concen (PPM)	Qul Eff	Process Description	Contaminant Name	Media	Sca le	Document Number	Test Num
1	0.9998226	6200.00000		1.10000		STABILIZATION	LEAD	SOIL	B	980-TSI-RT-FCAR-2	1
2	0.9997742	6200.00000		1.40000		STABILIZATION	LEAD	SOIL	B	980-TSI-RT-FCAR-2	1
3	0.9995161	6200.00000		3.00000		STABILIZATION	LEAD	SOIL	A	980-TSI-RT-FCAR-2	1
4	0.9993865	16.30000		0.01000		STABILIZATION	LEAD	SOIL	A	980-TSI-RT-FCAR-3	1
5	0.9989899	59.40000		0.06000	ND	STABILIZATION	LEAD	SOIL	A	980-TSI-RT-EURY-1	1
6	0.9989899	59.40000		0.06000	ND	STABILIZATION	LEAD	SOIL	B	980-TSI-RT-EURY-1	1
7	0.9987730	16.30000		0.02000		STABILIZATION	LEAD	SOIL	A	980-TSI-RT-FCAR-3	1
8	0.9985690	59.40000		0.08500		STABILIZATION	LEAD	SOIL	B	980-TSI-RT-EURY-1	1
9	0.9950920	16.30000		0.08000		STABILIZATION	LEAD	SOIL	A	980-TSI-RT-FCAR-3	1
10	0.9901840	16.30000		0.16000		STABILIZATION	LEAD	SOIL	A	980-TSI-RT-FCAR-3	1
11	0.9489790	9.80000		0.50000		STABILIZATION	LEAD	SOIL	A	980-TSI-RT-FCAR-1	1
12	0.9489790	9.80000		0.50000		STABILIZATION	LEAD	SOIL	B	980-TSI-RT-FCAR-1	1
13	0.7959180	9.80000		2.00000		STABILIZATION	LEAD	SOIL	A	980-TSI-RT-FCAR-1	1
14	0.6326530	9.80000		3.60000		STABILIZATION	LEAD	SOIL	A	980-TSI-RT-FCAR-1	1

SOIL - 14 data points SLUDGE (SLUD) - 0 data points

nk	Mobility Reduction	Influent Concen (PPM)	Qul Inf	Effluent Concen (PPM)	Qul Eff	Process Description	Contaminant Name	Media	Sca le	Document Number	Test Num
1	0.9996888	123.70000		0.03850		CEMENT SOLIDIFICATIO	ZINC	SOIL	B	980-TSI-RT-EUXT-1	1
2	0.9987206	12.11500		0.01550		CEMENT SOLIDIFICATIO	LEAD	SOIL	B	980-TSI-RT-EUXT-1	1
3	0.9811300	0.53000		0.01000		CEMENT SOLIDIFICATIO	CADMIUM	SOIL	B	ORD-TSI-RT-FHMF-1	1
4	0.9765000	0.01700		0.00040		CEMENT SOLIDIFICATIO	CADMIUM	SOIL	B	980-TSI-RT-EUXT-1	1
5	0.9467390	9.20000		0.49000		CEMENT SOLIDIFICATIO	ZINC	SOIL	A	ORD-TSI-RT-FHMF-1	1
6	0.6938800	0.49000		0.15000		CEMENT SOLIDIFICATIO	LEAD	SOIL	A	ORD-TSI-RT-FHMF-1	1

SOIL - 6 data points SLUDGE (SLUD) - 0 data points

nk	Mobility Reduction	Influent Concen (PPM)	Qul Inf	Effluent Concen (PPM)	Qul Eff	Process Description	Contaminant Name	Media	Sca le	Document Number	Test Num
1	0.9997167	35.30000		0.01000		FLYASH SOLIDIFICATIO	CADMIUM	SOIL	B	ORD-TSI-RT-FHMF-1	2
2	0.9986301	14.60000		0.02000		FLYASH SOLIDIFICATIO	ZINC	SOIL	A	ORD-TSI-RT-FHMF-1	5
3	0.9904774	395.90000		3.77000		FLYASH SOLIDIFICATIO	ZINC	SOIL	A	ORD-TSI-RT-FHMF-1	2
4	0.9863000	0.73000		0.01000		FLYASH SOLIDIFICATIO	CADMIUM	SOIL	A	ORD-TSI-RT-FHMF-1	4
5	0.9863000	0.73000		0.01000		FLYASH SOLIDIFICATIO	CADMIUM	SOIL	B	ORD-TSI-RT-FHMF-1	5
6	0.9718160	9.50000		0.27000		FLYASH SOLIDIFICATIO	ARSENIC	SOIL	A	ORD-TSI-RT-FHMF-1	2
7	0.9465753	14.60000		0.78000		FLYASH SOLIDIFICATIO	ZINC	SOIL	A	ORD-TSI-RT-FHMF-1	4
8	0.7857100	0.70000		0.15000		FLYASH SOLIDIFICATIO	LEAD	SOIL	A	ORD-TSI-RT-FHMF-1	5
9	0.6960227	70.40000		21.40000		FLYASH SOLIDIFICATIO	LEAD	SOIL	A	ORD-TSI-RT-FHMF-1	2
0	0.4714300	0.70000		0.37000		FLYASH SOLIDIFICATIO	LEAD	SOIL	A	ORD-TSI-RT-FHMF-1	4

SOIL - 10 data points SLUDGE (SLUD) - 0 data points

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ACRONYM GUIDE FOR THE ADMINISTRATIVE RECORD
MIDCO I & II SITES
GARY, INDIANA

ACRONYM	DEFINITION
USEPA	United States Environmental Protection Agency
DOJ(USDOJ)	United States Department of Justice
RI	Remedial Investigation
FS	Feasibility Study
IDOH	Indiana Department of Highways
IDEM	Indiana Department of Environmental Management
USDOI	United States Department of Interior
QAPP	Quality Assurance Project Plan
PRP	Potentially Responsible Party
ATSDR	Agency for Toxic Substance and Disease Registry
TAT	Technical Assistance Team
ERM	Environmental Research Management, Inc.
PRC	Planning Research Corporation
E & E	Ecology & Environment, Inc.

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ADMINISTRATIVE RECORD SAMPLING/DATA INDEX
MIDCO I & II SITES - GARY, INDIANA
Sampling/Data Documents have not been copied,
but are available for review at the locations noted below.

DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE
07/00/00	Data Packages, Custody Sheets, Field Notes for data in the Remedial Investigation. Available at Geosciences Research Associates, Bloomington, Indiana.	Geosciences & Compuchem	Geosciences	Sampling/Data
07/00/00	Data Packages, Custody Sheets and Field Notes for data in Biota Study. Available in OPM and CRL files, Region V-Chicago, IL, USEPA.	Hazelton & U.S.Fish & Wildlife	U.S.Fish & Wildlife	Sampling/Data

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GUIDANCE DOCUMENTS : INDEX
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Guidance Documents are available for review at
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TITLE	AUTHOR	DATE
Guidance on Implementation of the "Contribute to Remedial Performance" Provision.	OSWER Dir. 9360.0-13	87/04/00
Final Guidance for the Coordination of ATSDR Health Assessment Activities with the Superfund Remedial Process.	OSWER Dir. 9285.4-02	87/04/22
Superfund Selection of Remedy: Background Documentaion on Remaining Issues.		87/05/12
Superfund Public Health Evaluation Manual.	OSWER Dir. 9285.4-01	87/07/00
Interim Guidance on Compliance with Applicable or Relevant and Appropiate Requirements. 52 FR 32496 (8/27/87).	OSWER Dir. 9234.0-05	87/07/09
Interim Guidance on PRP's participation in RI/FS.	OSWER Dir. 9835.1a	87/10/02
Interim Guidance on Administrative Records for Decisions on Selection of CERCLA Response Actions.	OSWER Dir. 9833.4	87/11/09
Revised Procedures for Planning and Implementing Off Site Response Actions.	OSWER Dir. 9834.11	87/11/13
FY '88 Region V ROD Process Guidance. Memo from Chief of the Emergency & Remedial Response Branch - Waste Mgmt. Div.	Mary Gade-USEPA	88/01/20
Draft Guidance on Preparing Superfund Decision Documents: The Proposed Plan and ROD.	OSWER Dir. 9355.3-02	88/03/00
Draft Guidance on PRP Participation in the RI/FS.	OSWER Dir. 9835.1A	88/04/13
Record of Decisions Questions & Answers - Draft.		88/04/01
Community Relations During Enforcement Activities and Development of the Administrative Record.	OSWER Dir. 9836.0-1a	88/11/03
Redelegation of Authority Under CERCLA/SARA and Superfund Internal Delegation of Authority.	OSWER Dir. 9012.10	
Quality Assurance Plan For Superfund (Draft).	OSWER Dir. 9200.1-05	
Guidelines for Producing Superfund Documents.	OSWER Dir. 9200.0-01	
Superfund Community Relations Policy.	OSWER Dir. 9230.0-02	

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TITLE	AUTHOR	DATE
Community Relations Handbook.	OSWER Dir. 9230.1-03	
Community Relations Activities At Superfund Enforcement Sites - Interim Guidance.	OSWER Dir. 9230.0-03A	
Community Relations In Superfund - A Handbook Interim Guidance.	OSWER Dir. 9230.0-03B	
Community Relations Guidance For Evaluating Citizen Concerns At Superfund Sites.	OSWER Dir. 9230.0-04	
CERCLA Compliance With Other Laws Manual Vols. 1-3. (Draft)	OSWER 9234.1-01 to 03	
Interim Guidance On Compliance With Applicable Or Relevant And Appropiate Requirements (ARAR).	OSWER Dir. 9234.0-05	
User's Guide To The Contract Laboratory Program	OSWER Dir. 9240.0-01	
Analytical Support For Superfund.	OSWER Dir. 9240.0-02	
Superfund Analytical Data Revision And Oversight (Draft).	OSWER Dir. 9240.0-03	
REM II Contract Award Fee Performance Evaluation Plan	OSWER Dir. 9242.3-05	
e		
Implementation Of The Decentralized Contractor Performance Evaluation And Award Fee Process For Selected Remedial Program Contracts.	OSWER Dir. 9242.3-07	
Procedures Manual For Superfund Community Relations Contractor Support (Draft).	OSWER Dir. 9242.5-01	
Delegations Of Remedy Selection To Regions (Under Delegation 014-5)	OSWER Dir. 9260.1-09	
FWPCA Delegations Of Authority - Complete Set.	OSWER Dir. 9260.3-00	
Policy On Flood Plains And Wetlands Assessments.	OSWER 9280.0-02	
Recommendations For Groundwater Remediation At The Millcreek, Pennsylvania Site.	OSWER Dir. 9283.1-01	
Guidance On Remedial Actions For Contaminated Groundwater At Superfund Sites (Draft).	OSWER Dir. 9283.1-02	
Standard Operating Safety Guide Manual.	OSWER Dir. 9285.1-01B	

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TITLE	AUTHOR	DATE
Occupational And Health Technical Assistance And Enforcement Guidelines For Superfund.	OSWER Dir. 9285.3-01	
Employee Occupational Health And Safety.	OSWER Dir. 9285.3-02	
Superfund Public Health Evaluation Manual.	OSWER Dir. 9285.4-01	
Guidance For Coordinating ATSDR Health Assessment Activities With The Superfund Remedial Process.	OSWER Dir. 9285.4-02	
Health Assessments By ATSDR In FY-88.	OSWER 9285.4-03	
Superfund Exposure Assessment Manual (Draft).	OSWER Dir. 9285.5-01	
Memorandum Of Understanding Between ATSDR And EPA	OSWER Dir. 9295.1-01	
Guidance For Establishing The NPL.	OSWER Dir. 9320.1-02	
RCRA/NPL Listing Policy.	OSWER Dir. 9320.1-05	
Requirements For Selecting An Off-Site Option In A Superfund Response Action.	OSWER Dir. 9330.1-01	
Evaluation Of Program And Enforcement-Lead RODS For Consistency With RCRA Land Disposal Restrictions.	OSWER Dir. 9330.1-02	
Discharge Of Wastewater From CERCLA Sites Into POTWS	OSWER Dir. 9330.2-04	
CERCLA Off-Site Policy: Providing Notice To Facilities.	OSWER 9330.2-05	
CERCLA Off-Site Policy: Eligibility Of Facilities In Assessment Monitoring.	OSWER 9330.2-06	
Guidance For Conducting Remedial Investigations And Feasibility Studies Under CERCLA (Draft).	OSWER 9335.3-02	
Guidance On Preparing Superfund Decision Documents: The Proposed Plan And Record Of Decision (Draft).	OSWER 9335.3-02	
Participation Of Potentially Responsible Parties (PRPs) In Development Of RIs And FSs.	OSWER 9340.1-01	
Preparation Of Decision Documents For Approving Fund-Financed And PRP Remedial Actions Under CERCLA.	OSWER 9340.2-01	
Preliminary Assessment Guidance, FY-88.	OSWER [illegible]5.1-01	
Interim RCRA/CERCLA Guidance On Non-Contiguous Sites And On-Site	OSWER 9347.0-01	

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TITLE	AUTHOR	DATE
Management Of Waste Residue.		
Implementation Guidance For Solvent, Dioxin, And California List Wastes Subject To RCRA/HSWA Land Disposal Restrictions.	OSWER 9347.0-02	
Uncontrolled Hazardous Waste Site Ranking Systems (HRS) - A Users Manual.	OSWER 9355.0-03	
Superfund Remedial Design And Remedial Action Guidance (RD/RA).	OSWER 9355.0-04A	
Guidance On Feasibility Studies (FS) Under CERCLA.	OSWER 9355.0-05C	
Guidance In Remedial Investigations (RI) Under CERCLA.	OSWERR 9355.0-6B	
Data Quality Objectives Development Guidance For Remedial Response Actions.	OSWER 9355.0-07B	
Interim Guidance On Superfund Selection Of Remedy.	OSWER 9355.0-19	
RI/FS Improvements.	OSWER 9355.0-20	
The RPM Primer.	OSWER 9355.1-02	
Guidance For Conducting RI/FS Under CERCLA.	OSWER 9355.3-01	
Relationship Of The Removal And Remedial Program Under The Revised NCP.	OSWER 9360.06A	
RI/FS Improvements Followup.	OSWER 9355.3-05	
Guidance On Implementation Of The "Contribute To The Efficient Remedial Performance" Provision.	OSWER 9360.0-13	
Use Of Expanded Removal Authority To Address NPL And Proposed NPL Sites.	OSWER 9360.0-14	
Slurry Trench Construction For Pollution Migration Controls.	OSWER 9380.0-02	
Guidance For Cleanup Of Surface Tank And Drum Sites.	OSWER 9380.0-03	
Remedial Action At Waste Disposal Sites Handbook.	OSWER 9380.0-04	
Leachate Plume Management.	OSWER 9380.0-05	
Guidance Document For Cleanup Of Surface Impoundment Sites.	OSWER 9380.0-06	
54 FR. No. 7, 1055-1120	Federal Register	

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TITLE	AUTHOR	DATE
USEPA Technology Screening Guide For Treatment Of CERCLA Soils And Sludges.	EPA/540/2-88/004	
USEPA Guidelines For Groundwater Classification Under The EPA Groundwater Protection Strategy.	USEPA	06/12/86

ADMINISTRATIVE RECORD INDEX - UPDATE
MIDCO I
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HE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
	1	87/04/16	Record of phone call to Dave Homer of PRC Environmental. His only concern after reviewing the data on the slag sample from the north of Midco I is the leachability of the PAH's from the slag into the PAH's in the pond. However, he does not think that additional sampling is needed.	Rich Boice-USEPA		Communication Record	1
	1	85/11/14	Recommendation that one 90-foot monitoring wells be installed on the north of the site to determine if a deep sand aquifer is present.	Rich Boice-USEPA	Reobert Aten-USEPA	Correspondence	2
	3	86/03/13	Arrangements are being made to have 60 yards of clay delivered to the site for placement on top of the test pit locations.	Robert Aten-Geosciences	Rich Boice-USEPA	Correspondence	3
	2	86/04/07	Confirmation that the USEPA and the DOJ have no objections to placing a fence and gate along the west side of Blaine St. and repairing the existing fence on the other three sides of the site.	Robert Aten-Geosciences	Rich Boice-USEPA	Correspondence	4
	1	86/04/11	Revised schedules for deliverables.	Robert Aten - Geosciences	Rich Boice-USEPA	Correspondence	5
	1	86/05/16	Pqase II groundwater samples collected for metal analysis will be filtered.	Robert Aten-Geosciences	Rich Boice-USEPA	Correspondence	6
	10	86/05/19	Letter and table reflecting changes in the treatment of groundwater samples for metals.	James Keith-Geosciences	Rich Boice-USEPA	Correspondence	7
	1	86/06/03	Record pf a phone call	R. Aten-Geosciences	Richard Boice-USEPA	Correspondence	8

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HE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBE
			where Geosciences was denied their request for a reduction of the Phase II Groundwater parameter list by Boice of the USEPA.	Research Assoc.			
	7	86/06/18	Because of rapid recovery of the wells during slug tests, transducers will be used to record recovery and a pneumatic method used to depress the water levels. Also, a detailed aquifer pump test will be performed.	Robert Aten-Geosciences	Rich Boice-USEPA	Correspondence	9
	3	86/06/24	List outlining the status of tape downs conducted during residential well sampling.	Robbin Lee Zeff-Geosciences	Rich Boice-USEPA	Correspondence	10
	10	86/07/23	Revised schedules for completing work.	Robert Aten-Geosciences	Rich Boice-USEPA	Correspondence	11
	2	86/07/24	Notice that a pump test will be performed and that Geosciences would like to discharge the groundwater to the Gary Sanitary District Wastewater Treatment Plant.	Robert Aten-Geosciences	W.Lynch-Gary SanitaryDist	Correspondence	12
	1	86/07/28	Completion of additional 30-foot test boring and monitoring well (without attachement).	Robert Aten-Geosciences	Rich Boice-USEPA	Correspondence	13
	7	87/01/08	Comments on Array of Alternatives documents.	Rich Boice - USEPA	Roy Ball - ERM	Correspondence	14
	30	87/01/13	Review of Midco I & II RI Reports.	K.W.Brown-Texas A&M University	Rich Boice-USEPA	Correspondence	15
	87	87/01/15	Review comments on the Midco I & II RI Reports.	David Homer-PRC	Rich Boice	Correspondence	16
	63	87/01/16	Review and analysis of	Donald	Rich Boice-USEPA	Correspondence	17

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HE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCUMEN
			the first drafts of the Midco I and II RI Reports.	Smith-Pratt&Lambert,Tech. Con			
	9	87/01/29	Review and written comments on the Draft RI Report for Midco I dated 11/20/86.	David Hudak-U.S.Dept. of Interior	Rich Boice-USEPA	Correspondence	18
	3	87/03/06	Determination that additional sampling, analyses and evaluation are necessary.	Basil Constantelos-USEPA	Olian, Klettke, Barker	Correspondence	19
	1	87/03/11	Notice of an additional test boring near the pump test well.	Robert Aten-Geosciences	Rich Boice-USEPA	Correspondence	20
	3	87/03/13	Comments on Midco I and II Draft Remedial Investigations Reports.	Reginald Baker-IDEM	Rich Boice-USEPA	Correspondence	21
	3	87/04/13	Midco I and Midco II Progress Report.	Arthur Slesinger-Morton Thiokol	Rich Boice-USEPA	Correspondence	22
	15	87/05/04	Request for Information.	Basil Constantelos-USEPA	Donald Lucas-IDOH	Correspondence	23
	1	87/05/29	Midco I, ground water and surface sediment sampling activities.	Robert Aten-Geosciences	Rich Boice-USEPA	Correspondence	24
	21	87/06/17	Review comments to the second draft of the Midco I RI.	Basil Constantelos-USEPA	U.Klettke-Enterprise Co's	Correspondence	25
	21	87/06/18	Summary of how the Midco I data will be utilized for the purposes of the Risk Assessment.	Roy Ball-ERM North Central	Rich Boice-USEPA	Correspondence	26
	2	87/06/29	Letter in response to letter dated 6/18/87 and phone conversation of 6/24/87 from Roy Ball of ERM North-Central. 1. Justification for determination of ND levels for acetone and methylene chloride are not clearly presented. 2. Schedule of expected submittals by ERM to the	Rich Boice-USEPA	Roy Ball-ERM NorthCentral	Correspondence	27

ADMINISTRATIVE RECORD INDEX - UPDATE
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HE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
			USEPA. 3. Clarification of what is meant by localized contamination. 4. A number of wells were not identified on the well inventory. 5. Varying site conditions as a result of past site operations must be taken into account.				
	3	87/06/29	Letter attaching memo showing that a number of area residents in the neighborhood north east of Midco I have wells that are used for drinking water. ERM is asked to perform a house-to-house canvass to locate residential wells, determine their depth, and usage.	Rich Boice-USEPA	Roy Ball-ERM NorthCentral	Correspondence	28
	4	87/07/16	Preliminary review of the third draft of the Midco I RI.	Carole Biang-Roy F. Weston,Inc.	Rich Boice-USEPA	Correspondence	29
	2	87/07/21	Concerns over the third round of sampling.	Rich Boice-USEPA	Roy Ball-ERM	Correspondence	30
	13	87/07/31	Letter summarizing and responding to issues raised in recent correspondence regarding the draft RI.	Roy Ball-ERM	Rich Boice-USEPA	Correspondence	31
	2	87/08/07	Request for the IDOH's plans for addressing salt contamination from the Gary Subdistrict facility.	Valdas Adamkus-USEPA	John Isenbarger-IDOH	Correspondence	32
	[illegible]	87/08/12	Request for Information as a follow-up to one sent 5/4/87.	Basil Constantelos-USEPA	William Hay-[illegible]	Correspondence	33
	15	87/08/13	Response to comments on the Midco I RI Draft	Roy Ball-ERM North Central, Inc.	Rich Boice-USEPA	Correspondence	34

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IE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
			No. 3 and the Midco I Endangerment Assessment.				
	3	87/08/19	Letter attempting resolution of RI/FS issues.	Rich Boice-USEPA	Roy Ball-ERM	Correspondence	35
	3	87/08/20	Review of Midco I RI data.	Carole Biang-Roy F. Weston, Inc.	Rich Boice-USEPA	Correspondence	36
	18	87/08/27	Response to comments made on the Midco I RI drafts.	Roy Ball-ERM	Rich Boice-USEPA	Correspondence	37
	15	87/09/03	Review of the final RI.	K.W.Brown-KWB&A Env. Consultants	Rich Boice-USEPA	Correspondence	38
	2	87/09/18	Clarification of the United State's position that the development of the remedial action alternatives is a technical task based on an objective evaluation of those remedial actions are most conducive to minimizing or mitigating the threat of harm to public health, welfare or environment.	Joel Gross-US DOJ	B.Olian-Sidley & Austin	Correspondence	39
	18	87/09/22	Technical review comments on the Remedial Options Documents.	Kurt Stimpson-Roy F. Weston	Rich Boice-USEPA	Correspondence	40
	9	87/09/29	Comments on the draft preliminary list of remedial technologies and final comments on the RI.	Rich Boice-USEPA	Roy Ball-ERM	Correspondence	41
	2	87/10/29	Review of RI for Midco I and Ninth Ave. Dump.	John Isenbarger-IDOH	Rich Boice-USEPA	Correspondence	42
	1	87/11/18	Approval of the final RI.	Rich Boice-USEPA	Roy Ball-ERM	Correspondence	43
	2	87/12/09	Comments on Task 9 of the FS.	Dave Homer-PRC	Rich Boice-USEPA	Correspondence	44
	2	87/12/14	Outline of IDOH's Consultant's proposed activities regarding Midco I and Ninth Ave. Dump.	D.W.Lucas-IDOH	Rich Boice-USEPA	Correspondence	45
	14	88/01/12	Ground Water Contribution to	Blaie Millano-ERM	Rich Boice-USEPA	Correspondence	46

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HE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
			Surface Water Concentrations at the Midco Sites.				
	7	88/03/31	Analysis of Phase 4 of Cyanide Sampling.	Roy Ball - ERM	Rich Boice-USEPA	Correspondence	47
	2	88/04/25	Comments on the FS.	John Isenbarger-IDOH	Rich Boice-USEPA	Correspondence	48
	2	88/05/17	Review of the Progress Report No. 34.	Rich Boice-USEPA	Roy Ball-ERM	Correspondence	49
	9	88/07/06	Comments on the FS.	Dave Homer-PRC	Rich Boice-USEPA	Correspondence	50
	22	88/07/07	Review of the FS & Dissipation of Groundwater Alternatives.	Frederick Test-Roy. F. Weston, Inc.	Rich Boice-USEPA	Correspondence	51
	43	88/07/17	Review of Midco I draft FS.	Rich Boice-USEPA	Roy Ball-ERM	Correspondence	52
	6	88/08/18	Notice that a release of hazardous substances, pollutants and contaminants may be attributed to the IDOH facility.	Mary Gade-USEPA	William May-IDOH	Correspondence	53
	9	88/08/25	Comments on new alternatives requested by the USEPA for the FS.	Roy Ball - ERM	Rich Boice-USEPA	Correspondence	54
	24	88/09/19	Response to USEPA letter of 8/7/87 and followup letter of 8/18/88 alleging possible contamination from the IDOH Gary Subdistrict facilty.	John Isenbarger-IDOH	Valdas Adamkus-USEPA	Correspondence	55
	3	88/09/29	Preliminary review of the QAPP for the solidification tests.	Rich Boice-USEPA	Roy Ball-ERM	Correspondence	56
	6	88/09/30	Review of cleanup action levels at Midco I.	Dave Homer - PRC	Rich Boice-USEPA	Correspondence	57
	4	88/10/07	Review of the QAPP for the solidification tests.	Rich Boice-USEPA	Roy Ball-ERM	Correspondence	58
	3	88/10/14	Technical review of cleanup action levels for Midco I.	Frederick Test-Roy F. Weston, Inc.	Rich Boice-USEPA	Correspondence	59
	10	88/10/31	Additional Indiana Air Pollution Regulations for Indiana ARAR's.	Reginald Baker-IDEM	Karen Vaughn-Dames&Moore	Correspondence	60

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CHE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
	6	88/11/04	Technical reviews of revised draft FS for Midco I Site and IDOH letter of 9/19/88.	Frederick Test-Roy F. Weston,Inc.	Rich Boice-USEPA	Correspondence	61
	9	88/11/11	Revision to Weston's comments on the FS.	Frederick Test-Roy F. Weston, Inc.	Rich Boice-USEPA	Correspondence	62
	6	88/11/18	Review of Appendices A & D in the FS's for Midco I & II.	David Homer-PRC	Rich Boice-USEPA	Correspondence	63
	2	88/11/29	Contention that the available data clearly shows that the IDOH facility is the major source of the very higt chloride,sodium,TDS and conductivity plume in the groundwater near the site.	Valdas Adamkus-USEPA	John Isenbarger-IDOH	Correspondence	64
	4	88/12/02	Revisions and additions to the FS.	Rich Boice-USEPA	Roy Ball-Env.Resouce Mgmt	Correspondence	65
	5	88/12/05	Response and comments to the Sampling and Analysis Plan.	Elsie Millano-ERM	Rich Boice-USEPA	Correspondence	66
	5	89/01/03	Clarification of the criteria that will be used to evaluate the effectiveness of in-situ vapor extraction followed by in-situ solidification/ stabilization.	James Mayka-USEPA	Roy Ball-ERM	Correspondence	67
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